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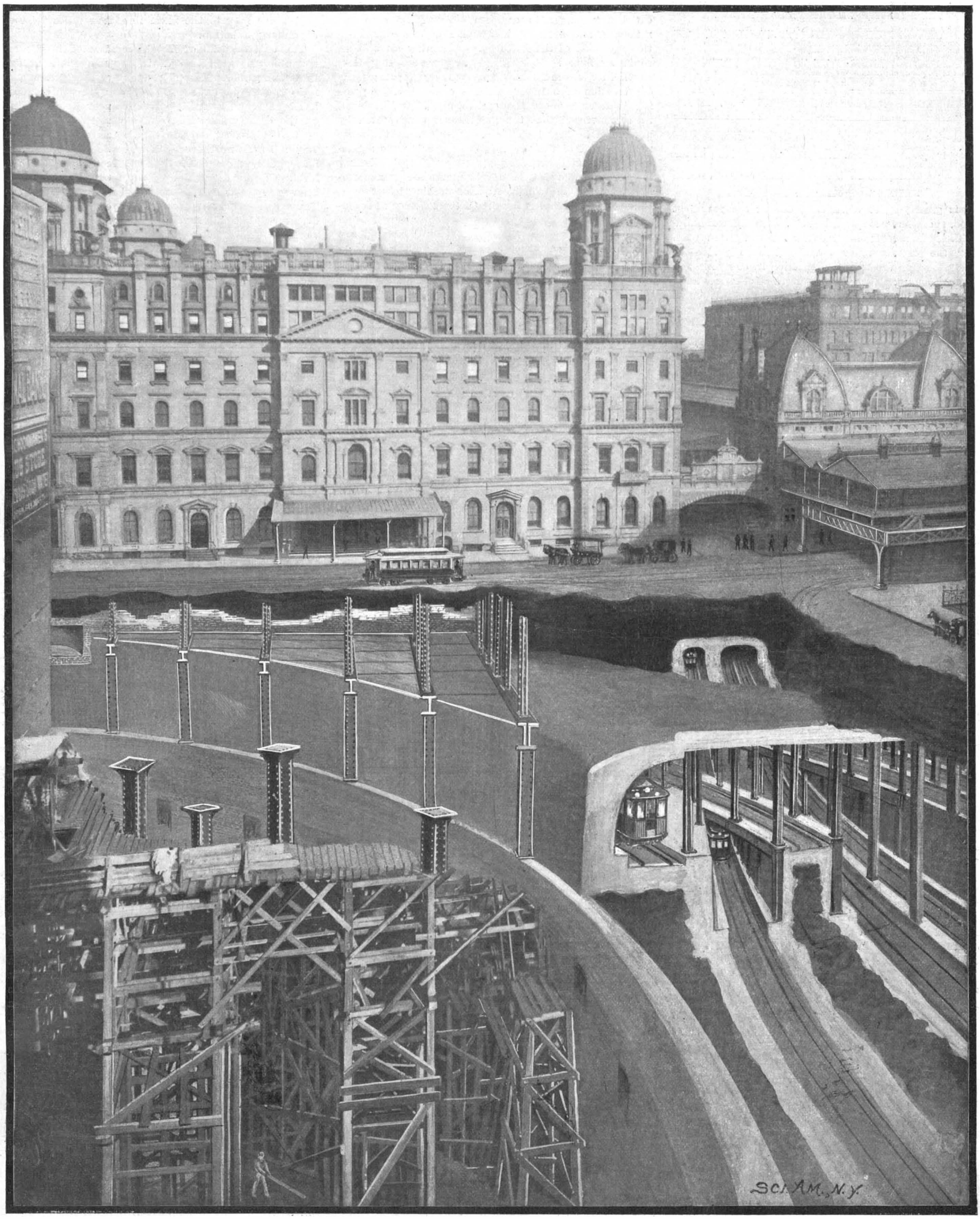

GRAND CENTRAL STATION IMPROVEMENTS AND TRACK CONNECTION WITH THE RAPID TRANSIT SUBWAY.—[See page 39.]

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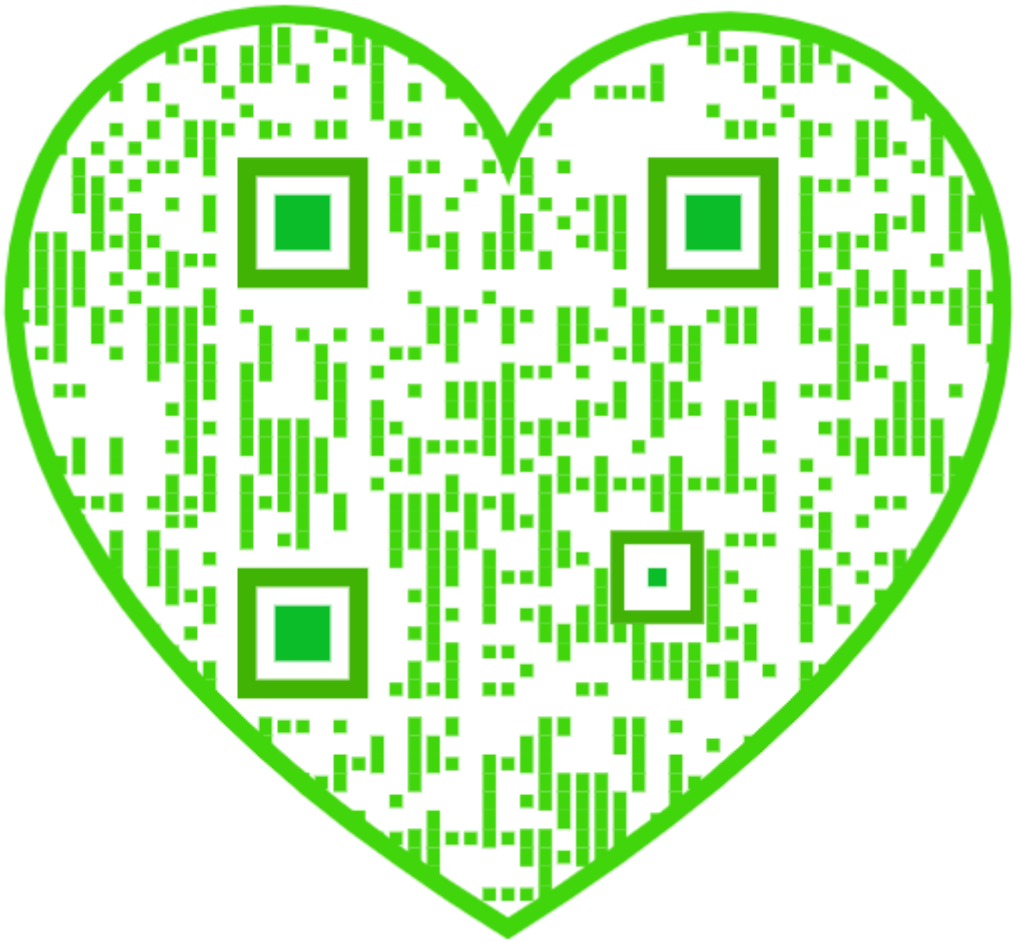

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NEW YORK, SATURDAY, JANUARY 17, 1903.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RAILROAD BUILDING IN 1902.

It is gratifying to learn that, during the year just closed, there has been greater activity in railroad building than in any twelve months for ten years past. After the extraordinary activity of the period of 1885-1890, when the total construction in one year was about 12,000 miles, there was a rapid decline until 1895, when the small total of 1,428 miles was built. Since that year there has been a steady increase, the total in 1898 being 3,265 miles; in 1900, 4,894 miles; in 1901, 5,368 miles; while in 1902 the total exceeded 6,000 miles. All but a few of the States in the Union participated in this extension. The greatest aggregate length, 570 miles, was laid in Oklahoma; the West, as is natural, being the field of the greatest activity. The second greatest length of road was that built in Texas, where about 500 miles were constructed. Then follow in their order Arkansas, with 370 miles; Indian Territory, with 363 miles; and Georgia with 336 miles. In addition to the total track embraced in these figures, it must be remembered that a considerable length of second track and track for sidings was constructed. There was also a vast amount of reconstruction work carried out which does not figure in this estimate; and this, if recorded, would convey an even stronger impression of the gratifying railroad activity of the year just closed.

NEW SHIPS FOR THE NAVY.

It is now probable that the naval appropriation bill, as presented to Congress, will be changed as regards its main provision for new ships, so that instead of recommending the construction of two battleships of the "Connecticut" class and two cruisers of the "Tennessee" class, three battleships and only one cruiser will be recommended. Although the number of ships of the first class called for will be the same, the change involves a great increase in actual fighting power, for there can be no comparison in this respect between a "Connecticut" and a "Tennessee." Although it is claimed by some naval officers that the "Tennessee" could put up a stiff fight against many modern battleships, it is certain that she could not stand up very long against our own "Connecticut." The total number of heavy guns on the cruiser is twenty, while the total number on the battleship is twenty-four. It would be a case of four 10-inch guns against four 12-inch, and sixteen 6-inch guns against twelve 7-inch and eight 8-inch guns, while as against the 5-inch armor of the cruiser the battleship would offer a protection of 11 inches. In addition to the three battleships and the armored cruiser, Congress will be asked to authorize two training ships and a small brig for training the younger apprentices in our navy.

While there is reason to be gratified with the proposal as thus drawn up, we cannot but regret that steps are not being taken by the present Congress to commit the country to an elaborate programme of construction, calling for a certain number of ships to be built each year, the appropriations to be voted as they are required. Such a course would insure a steady growth of the navy along predetermined lines, and at the same time it would be sufficiently elastic to allow of supplementary programmes being passed at any time—a method which is being followed with great success in the German navy. Another provision of the naval bill which will meet with universal approval, is that for an increase in the personnel to correspond with the increase in the number of ships in commission. The bill will call for the immediate doubling of the number of cadets in the Naval Academy; when it is passed one of the most serious defects in the naval policy of this country will have been remedied.

RECONSTRUCTION OF THE ERIE CANAL.

There is unquestionably a growing conviction among the people of this State that it is indispensable, both to the commercial supremacy of its principal seaport and to the full realization of the commercial possibilities of the State itself, that the Erie Canal should be rescued from the condition of neglect and inefficiency into which it is so rapidly declining, and restored to something of its original standing as the most important line of transportation through the State of New York. Every year that passes brings nearer the day when, if the canal be not modernized, it will have to be abandoned altogether. As matters now stand the barges are too small, and the locks too many and too slow of operation to enable the canal any longer to compete successfully with the railroads, and act as the guardian of the transportation interests of the State by maintaining rates at an equitable figure. It is gratifying to note that Gov. Odell, in his annual message, strongly advocates the construction of a 1,000-ton barge canal, thereby proving that, on a more thorough study of the problem, he is convinced that the half-measures advocated by him when he first took office, contemplating the mere improvement of the present 9-foot canal, were a mistake, and that a broader view of the question, taking in the probable future developments of transportation, demands the construction of nothing less than a 12-foot, 1,000-ton barge canal. Of the schemes of reconstruction proposed, there are practically three. One proposes to follow the Niagara River to a point above Niagara Falls; construct a canal around the Falls to Lewiston and thence to Lake Ontario, or else use the present canal as far as Lockport, and construct a canal from Lockport to Olcott on the lake; then use the lake itself as far as Oswego; proceed by the route of the old Oswego Canal to Syracuse, and then follow the course of the present Erie Canal from Syracuse to the Hudson River. Another scheme proposes to utilize Lake Ontario and the St. Lawrence River to the point on the river to the north of Lake Champlain, where it will be most practicable to "break through;" construct a canal from there to Lake Champlain; and then follow the old canal from Whitehall down to Troy. Now, while these two schemes save a large amount of canal construction or reconstruction, they are open to the objection that the navigation of the lake is at times extremely stormy and that, therefore, the barges would have to be built much more strongly than they would if they used an all-canal route, the difference being estimated at as high as 20 per cent. There is also the drawback of heavier insurance rates; while in respect of the lake and St. Lawrence route there will be the danger that having got so far down the St. Lawrence River, the freight might be tempted to use the St. Lawrence River altogether; in which event the canal would defeat the very object for which it was built.

The third route, which is the one recommended by Gov. Odell, is known as the inland route. It follows approximately the route of the present Erie Canal from Buffalo to a point a few miles beyond Lyons. Here it leaves the old canal and is laid through easier country to the north of it, finally entering the western end of Oneida Lake, traversing that lake and striking the route of the present canal between Oneida and Rome. From this point on through the Mohawk Valley it is proposed to abandon the old canal, and utilize instead the Mohawk River, canalizing the same and dredging or excavating it to the required prism. The last route is the one recommended by a sub-committee of the Canal Association of Greater New York, and it is generally favored by the engineers on the ground of construction, and by the experts in traffic, who judge it from the standpoint of economy and facility of ultimate operation. In the current issue of the SUPPLEMENT we publish a map showing the alternative routes, and also an exhaustive analysis of the discussion of the problem contained in Gov. Odell's report.

THE COAL FIELDS OF NATAL.

The building of the various railroads projected in South Africa, and the completion of those now in course of construction, the scope of which was described recently in the SCIENTIFIC AMERICAN, will tap, and bring into communication with the coast, the various extensive and rich coalfield areas of South Africa, so that in the near future that country will play an important part in the world's supply of coal.

A considerable part of Natal, and several large tracts of country in the Transvaal and Cape Colony, contain rich coalbeds, many of them as yet unexploited. To stimulate the coal-mining industry, and in order to attract attention to the immense possibilities in this connection in South Africa, the British Board of Trade have issued a report dealing with the question. The coal-producing areas may be divided into four districts. The first district comprises the largest coal mine in Cape Colony, the Indwe Mine, furnishing about half the total output of the colony. It is connected with the main railroad at Sterkstroom by a branch track 66½ miles in length. The second largest producing district comprises the mines of the Cyphergat Coal Mining Company (Limited), the Wallsend Colliery Company (Limited), the Fairview Coal Mining Company, and the Sterkstroom Mines. The third area comprises the mines in the Molteno district; the fourth district is the smallest, and includes the Romansfontein mine, twelve miles southwest of Molteno and six miles from the terminus of the Cape Collieries Railroad; the principal mine of the Cape collieries is on the farm of Zeekoegat. Other mines of this company are the Speedwell and Silkstone collieries on the Zandfontein farm. The company has built a railroad 17½ miles long to the main line, four miles west of Stormberg Junction.

The coal deposits of Natal are situated in the extreme northern portion of the colony, the southern limit being a line drawn east and west about twelve miles north of Ladysmith. Outside this area, coal has been found in small quantities near Estcourt, and on the coast northward from Mount Edgecombe, but up to the present only in thin seams of no practical value. In the northern district the deposits lie almost horizontally from 3,800 to 4,000 feet above the sea level. On the other side of the mountains, coal has been found near Charlestown, and at Volksrust in the Transvaal. About a dozen seams of coal have been discovered, but only four or five of these are at present worked. The Dundee district is at present the best developed area, and here the seams go up to four feet six inches in thickness, and yield coal of good quality. Further north, between Dundee and Ingagane, prospecting operations have revealed seams of good coal up to six feet in thickness, which were just being developed previous to the war. In the Newcastle district both the quality of the coal and the thickness of the seams are very variable. The coal fields of Rhodesia are situated some 180 miles northwest of Bulawayo, and are known to extend over 400 square miles. The seams vary from 5 feet to 16 feet in width, and as the coal lies within 40 feet of the surface, it will be worked by means of inclines instead of shafts. In so large an area the quality naturally varies, but it is claimed that the coal is better than that now in use in the Cape Colony, Natal, and the Transvaal.

The output of coal in Natal has been steadily increasing. The figures for the last five years are: 1897, 243,960 tons; 1898, 387,811 tons; 1899, 328,580 tons; 1900, 241,330 tons; and 1901, 569,200 tons. The export of coal from Natal in 1901 amounted to 204,788 tons, of which 55,757 tons were exported from Durban by sea, 1,865 tons overland to Orange River and Transvaal colonies, and 241,166 tons were bunkered by vessels at Durban. The total output of the collieries being 569,200 tons, it will be seen that 264,412 tons were either consumed or stocked in Natal; 146,234 tons of colonial coal were consumed on the Natal Government Railroads during 1901. The output of the Cape collieries in 1898 was 191,853 tons. The development of the coal areas and prospecting for new deposits is going on steadily. The largest market for coal in South Africa is that of the Witwatersrand gold fields. For the coal of Natal, the bunkering trade of Durban has furnished the largest market up to the present, the Natal Government Railroads being the next largest consumers. The demand in South Africa for its coal is equal to the supply. Nearly all the mines can readily sell all the coal they can produce, and most of them would increase their output if labor were more plentiful. Many of the companies suffer from the scarcity of labor. The railroad system on the whole affords fair facilities for the development of the coalfields. In 1899 the committee on coal for railroad purposes recommended a reduction of the tariff for coastwise conveyance of colonial coal in return empties, from the rate of a cent to half a cent per ton per mile from Stormberg to East London, from Rosemead to Port Elizabeth, and via De Aar to Capetown, the rate of a cent per ton per mile to operate only for the distance from Sterkstroom, via Stormberg Junction, to Rosemead Junction; and that all these rates should be also for intermediate stations *en route* to the ports. They did not recommend a reduction of the existing rate for coal northward. In making these recommendations the committee were of the opinion that, if accepted, they would lead to the use of colonial coal in a very considerably greater degree, and for a great many more new purposes than it had been used, would add to the net revenue of the colonial railways, and would enable the consumer to obtain colonial coal at a cheaper rate. Next year it is anticipated that the extensive and virgin regions of the Wankie country will be tapped by the Cape to Cairo Railroad. Although at present South Africa can scarcely meet the native demands for the fuel, as new regions are opened, and the output of those already in operation is increased, the country will be in a position to direct its attention to foreign markets.

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SIR HARRY JOHNSTON'S EXPLORATIONS IN UGANDA AND CENTRAL AFRICA.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The feature of the opening meeting in London of the winter's session of the Royal Geographical Society of Great Britain was Sir Harry Johnston's lecture on "The Uganda Protectorate, Ruwenzori, and the Semliki Forest." Sir Harry Johnston is the residential Commissioner for the British government in Uganda, and in the course of his official duties he thoroughly explored the Protectorate and the surrounding country, gained some valuable information, and made several important discoveries of scientific interest. Since his return to England, Sir Harry Johnston has refrained from divulging any information regarding his researches, with the exception of the okapi, until the results of his work had been thoroughly investigated by the leading scientists and explorers. Consequently, special interest was evinced in his address to the Royal Geographical Society.

Sir Harry Johnston, in his lecture, took the Uganda Protectorate province by province, and gave original information about each province in turn. The provinces are six in number—Eastern, Rudolph, Central, Nile, Kingdom of Uganda, and Western. The traveler from Mombasa, before reaching the frontier of Uganda, passes through the country of Kikuyu, which is well forested and thickly clothed with vegetation. As he descends into the Rift Valley, the Kikuyu vegetation decreases in luxuriance. In the vicinity of Lake Naivasha there is a short sweet grass, which is probably kept low by the browsing of innumerable antelopes and the herds of Masai cattle. The Masai of the Naivasha district belong to the essentially cattle-keeping, semi-nomad division of that race. Quite recently, for political reasons, it had been thought advisable to make the Masai dwelling within the eastern province of the Uganda Protectorate independent of any political connection with those of the adjoining East Africa Protectorate or of German East Africa. Unfortunately, at the present moment, the Masai race is on the road toward extinction, either by dying out or by fusion with other tribes. During the last year or so, however, there has been a marked increase in prosperity among the Masai of Naivasha, and it is hoped that in this region they will increase, multiply, and preserve the purity of race. From the northeastern buttresses of Mount Elgon, and the headwaters of the Weiwei River on the north, to the frontier of German East Africa on the south—a distance of about 240 miles—extends, at altitudes ranging between 5,000 feet and 10,000 feet, one of the most beautiful and healthful districts to be found anywhere in the Dark Continent. This lofty region Sir Harry Johnston has styled the Nandi plateau, as it is mainly inhabited, at present, by races of the Nandi stock. This beautiful land has not in it a single ugly or unfriendly spot, and as it is almost entirely without native inhabitants, it seems to be waiting the advent of another race to make it a wonderland of wealth and comfort. It is situated exactly under the equator, at an average altitude of 4,000 feet above the Victoria Nyanza.

Sir Harry Johnston traveled completely round Mount Elgon. On its southern as on its northern side, the awful mountain cliffs which mark one of the lower terraces of this tremendous crater are honeycombed with deep recesses or caverns. These are the well-known caves of Elgon, the caves which were first discovered by Joseph Thomson. Sir Harry Johnston visited several caverns, including the one which was the first cave reached and discovered by Joseph Thomson, whose visit the natives still remembered vividly. This cave is marked by a splendid waterfall. It was the descent of the Sasuru River, and he named it the Thomson Falls. Joseph Thomson left behind him here, as wherever else he passed in Central Africa, the most pleasing memories. As if by fate, Sir Harry Johnston often traveled in Thomson's footsteps, and he always noted that where Thomson had been, the first white pioneer, his admirable treatment of the natives had insured a kindly welcome to those who followed. The native inhabitants of West Elgon were of the greatest interest. They were of rather a mixed stock, but all were of very low and ape-like appearance. The greatest interest they possessed lay in the fact that they spoke a Bantu language, which, of all those discovered, possibly came nearest to the original form of the Bantu mother tongue.

From the Sabei country, he was obliged to travel for sixteen days to the ravine station without a road, simply guiding his caravan by the map and eye. From the northeast of Elgon to within sight of the ravine station, he passed through a land whose only human inhabitants were a few wandering and fugitive Andorobo—a land simply swarming with big game. The caravan saw large herds of elephants first, then many rhinoceroses, then literally countless hartbeests, water buck, reed buck, Cobus antelopes, bustard hartbeests, and orobi. Herds of zebras would follow the caravan, snorting and kicking up their heels. There were lions, leopards, warthogs, jackals, and many ostriches. Last of all, in the middle of the Gwas Ngishu plateau, where forests of acacia still lingered, the expedition encountered giraffes, some with five horns appearing to be a new species of that remarkable animal, and seemingly the common form of giraffe between Elgon on the west and Lake Baringo on the east. Seen from a distance, these giraffe, when full grown, appeared to be black, but to have white bellies and limbs. Here and there monsters stood on the tops of large anthills or small hillocks, sentries posted to warn the feeding herds of the approach of the giraffe's only enemies, man and the lion. Yet so little had man harassed these creatures during recent years, since the plateau was divested of its human inhabitants, the Gwas'Ngishu Masai, by civil wars, that these sentinels took little or no notice of the caravan. Four specimens were secured—two males and two females—for the British Museum. Sir Harry Johnston crossed the Semliki River opposite Fort Mbeni, and traveled for three days in the dense Congo forest. He fully indorsed all that Stanley had said about the awesome nature of these appalling woods. He employed his time in this forest by visiting the Pygmies at home, and seeing their little settlements of tiny huts constructed of withes and leaves. He also encountered the strange, prognathous, ape-like people, who seemed to be a race of pariahs dwelling on the fringe of other tribes; and he ascertained that the real gorilla comes pretty near to the Semliki in its distribution. He was of the opinion that other remarkable discoveries of hitherto unknown mammals were to be made in this huge forest, besides that of the okapi. As it was, skins of several other beasts new to science were obtained. The natives everywhere were found to be on friendly terms with the Belgian authorities, and the excellent roads and well-built stations, together with abundant supplies of the comforts and necessaries of existence from Antwerp merchants, introduced a strange element of civilization into these otherwise trackless wilds.

The southwestern part of the Uganda Protectorate consists of the district of Ankole. A portion of this noble country rises to heights of 8,000 feet and 9,000 feet, and here reappears the Alpine vegetation of Ruwenzori, Elgon, and the Nandi plateau. Among these mountains are scattered almost innumerable crater-lakes, which provide landscapes of exquisite beauty. They nearly all contain fish. The scenery round these crater-lakes is so extravagantly beautiful that, coupled with the fact that they were in a country possessing a very healthy climate and few inhabitants, they might some time become the seats of small European settlements. The northern part of Ankole is somewhat drier and less equatorial in climate. It has a more parched appearance, at any rate during the dry season, and is of lower altitude. Here there is a certain amount of big game, including buffalo, rhinoceros, and eland. The people of Ankole consist of a race of sturdy negroes—the Ba-iro—and an aristocracy of Ba-hima, who are obviously descended from a Gala, Somali, or other Hamitic stock. As regards features and complexion, men and women were often seen among the Ba-hima who were more like Egyptians than was the case with the Galas and the Somalis. But strange to say, the hair of the head is much more wooly and negro-like than is the case with Galas and Somalis. Some men and women were so light in complexion that Sir Harry Johnston thought they were some of Emin Pashas refugee Egyptians, until it was proved to him that they had been born and bred in Ankole. These people, no doubt, were the origin of many of the legends of a white race dwelling in equatorial Africa. Among other points they were remarkable for their domestic cattle, which had more or less straight backs, were of large size, and had enormous horns. On the whole, the breed agreed remarkably closely with the long-horned cattle depicted in the Egyptian frescoes, and the explorer believed that this race was the stock from which the long-horned South African cattle were derived. Sir Harry Johnston also described his explorations of the Ruwenzori range of snow mountains, which remain still the most mysterious and least known mountains in Africa. In his opinion this is, certainly, of all African mountains of his acquaintance, that which is the most constantly cloud-covered. The explorer is convinced that the highest point of Ruwenzori is not under 20,000 feet in altitude, and that it would therefore be found to be the highest mountain on the continent of Africa. When, after the most arduous climb he had ever experienced, his highest point was reached on the flanks of the snow range—14,800 feet—the mountain above him seemed a thing he had only begun to climb, and towered, as far as he could estimate, another 6,000 feet, into the dark blue heavens. Perpetual snow, however, lay as low as 13,000 feet. To effect a complete and successful ascent of the highest points of Ruwenzori required as elaborate a preparation as the exploration of the Andes or the Himalayas. An enormous deal remained to be done in the exploration of this, the most important range of Africa.

In the course of his lecture Sir Harry Johnston reproduced, by means of the phonograph, records of many of the native songs of Uganda, utilized in their war dances, festivals, and orgies, as well as many of the dialects of the various tribes he met in the course of his journeys.

SCIENCE NOTES.

George K. Cherrie, curator of the Brooklyn Museum, sailed early in September on an expedition into South America in search of specimens of butterflies and mammals. He was accompanied by Benjamin Gault of Chicago, who will scan the same country in the interest of the Field Columbian Museum for relics of the prehistoric ages.

The largest pair of animal tusks ever found in the frozen North have arrived in Seattle from Keenwalik, a mining camp 300 miles northwest of Nome, well within the Arctic circle. The remains of the animal were found by M. F. Moran, the postmaster of Keenwalik, and will be forwarded to the Smithsonian Institution. The tusks are twelve feet from end to end. One weighs 168 and the other 172 pounds. Both are in an excellent state of preservation, the ivory being perfectly sound and of fine quality.

In order to give the British Association a free trip to Central Africa, the British South Africa Company will spend $35,000. The next meeting of the Association will, therefore, be held in 1905 at the Victoria Falls on the Zambesi River. Not far from Victoria Falls, Livingstone found the only indication of coal so far discovered in tropical Africa. Day by day the railway from Capetown and Bulawayo is drawing nearer to Victoria Falls, where the South Africa Company will soon turn the enormous water power available, into electricity. A hotel is to be built for the accommodation of the British scientists.

Before the British Association, Dr. W. E. Wilson, F. R. S., briefly described a new bolometer of his which would be very valuable for cloud observations. The bolometer is not simple. It consists of two coiled and blackened platinum wires, contained in a tube from which air is exhausted. The tube is driven by a clock-train which runs for a week. The one coil is exposed to the sunlight, the other kept in the shade. The new instrument is reported superior to others of the Callendar type, previously employed. The calibration of the instrument is effected with the aid of an electric current which heats one of the bolometer strips.

Dr. G. H. Bryan has raised the question of the escape of light gases from planetary atmospheres. The question was suggested by the apparent absence of helium and also of hydrogen from our atmosphere, and the apparent want of a lunar atmosphere, and is exceedingly difficult to deal with; many assumptions have to be made, for instance, as to the temperature of the outer layer of our atmosphere. Prof. Bryan now comes to the conclusion that helium and hydrogen might escape at negligible rates if the mean probable velocity were ten times as large as we assume it to be at ordinary temperatures. In reality there is probably only diffusion of the light gases into the higher strata. Prof. Bryan offered figures as to the amount of hydrogen we should have to generate to keep the quantity of atmospheric hydrogen constant, supposing that it were one of its constituents. Asked whether these two gases would still be in our atmosphere if they had been there when the earth was at high temperature, Prof. Bryan replied that that was a far wider and very difficult problem, since mass would in that period have been much more diffused than now.

THE RAISING OF A BIG RAILWAY BRIDGE.

On January 5 the huge Pennsylvania Railway bridge crossing the Passaic River at Newark was raised. The steel structure was divided into three parts, two of which were first lifted 13 feet above their former level, whereupon the raising of the third part began. The work was accomplished by nightfall of the same day. The reason for the lifting of the bridge is to be found in the fact that the tracks through Newark are elevated. A second bridge crossing the Passaic, and used by local and freight trains ordinarily, is now in use for all traffic until the main bridge is raised to the height of the track elevation and is made safe for travel.

An electric dynamo which had been installed in the Yale & Towne Works at Stamford, Conn., burst on January 3, while it was being tested. At the time of the accident the machine was making 3,600 revolutions per minute and had been running at top speed for ten minutes. Although there were six or eight men in the dynamo room at the time, and huge fragments weighing from 200 to 300 pounds were scattered about, no one was injured. The windows and woodwork, however, were badly damaged.

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The New York Automobile Show.

The third annual automobile show to be held in this city will be open from January 17 to 24. As usual, the exhibition will be held in Madison Square Garden, which, on account of the great increase in the industry the past year, is not large enough to accommodate all who wish to make exhibits, even with the utilization of every available inch of space in the basement and restaurant. The general lines of improvement to be noted are longer wheel base, wooden wheels all of the same size, and three-speed gears on the gasoline cars.

EUROPEAN FIRE ENGINES.

In the general arrangement of the German fire engine, a horizontal motor is built in over the rear axle, so as to be easily controlled from the engineer's platform at the back. Both the driving and the pumping gear are actuated by means of independent friction clutches situated upon the elongated crank-shaft. The arrangement is such that either clutch may be used without regard to the other, so that, while the engine is running to the fire, the pumping mechanism is at rest; but as soon as it arrives upon the scene of action, the pump may be started at once. About the center of the wagon frame, and easily accessible from either side, is placed the pump. Over the forward wheels are carried the requisites, such as the hose, tools, a tank for benzine, and seats for the accommodation of four men composing the crew.

The wagon frame is made of wrought iron, and rests upon heavy elliptical springs mounted on the axles. The motor is a horizontal two-cylinder, Deutzer benzine motor, of 15 brake horse power, the ignition being by a magneto, which assures the motor's starting without delay.

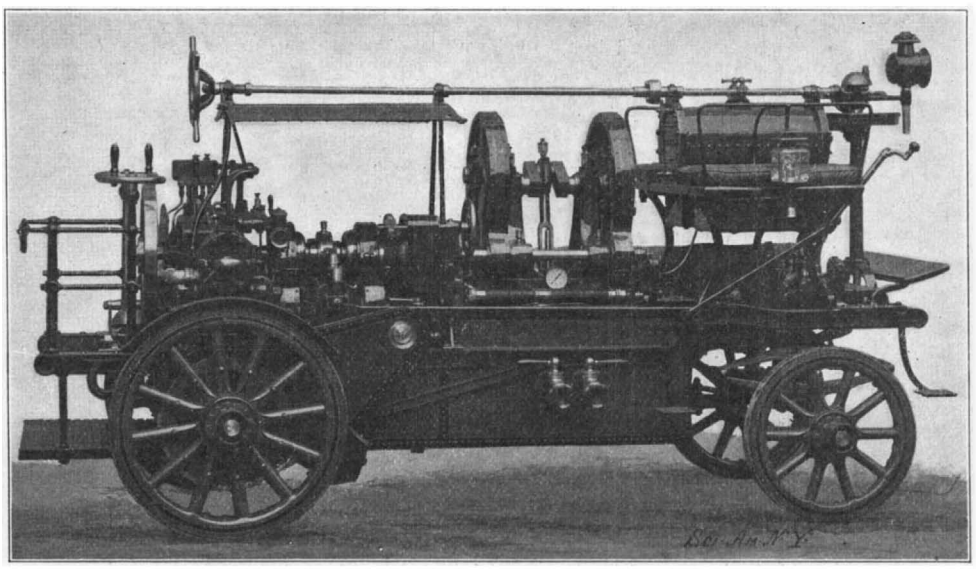
In its readiness to start this motor possesses a great advantage over a steam engine, which requires from 10 to 20 minutes to get up steam, or, to save this delay at the critical moment, incurs the expense of keeping up steam continuously in a separate boiler. Benzine is fed automatically to the engine from an air-tight tank provided with an automatic valve. Enough benzine is contained in the tank to insure a 10 hour run, using the fluid at the rate of 5 liters per hour. The water for cooling the gas engine cylinders is supplied by a separate pump, from a tank attached to the main 132-gallon pumping reservoir* under the center of the wagon. The two tanks are so connected that the cooling water may be obtained from the main one if a larger supply is needed.

An automatic lubricating device conducts oil from a centrally located reservoir to all necessary points. The control on the motor and speed clutches is easily effected from the engineer's platform at the back. The hand wheel seen operates the clutches, giving two speeds ahead of from 6 to 7½ and 9 to 12 miles per hour respectively, and a slow reverse.

The gears for furnishing these speeds consist of rawhide pinions meshing with iron or bronze gears. A chain drive is employed from the countershaft to the rear wheels.

During the run the steering is done from the driver's seat on the left side of the wagon, but it may also be done from the engineer's station at the rear. The two brakes, operating independently of each other, may also be worked from either place. All the gears are inclosed and run in oil.

The pump consists of three perpendicular brass cylinders having phosphor-bronze plungers ground to an air-tight fit. A valve chest, cast of solid brass, connects the cylinders, and contains a pair of valves for each cylinder, which open into the common suction and pressure chamber. The valves may be removed separately without the use of a tool, and returned to their proper seats or renewed in a few seconds. The suction pipe is provided with one, and the pressure pipes with two connections outside the reservoir. These connections have suitable valves and both the suction and pressure pipes have sufficiently large air chambers. In the pressure pipes of the pump are located safety and discharge valves, by means of which all surplus water may be returned to the reservoir, and the pressure at the same time be maintained constant. The safety valve is automatic and may be set for any desired pressure; the discharge valve is worked by hand, and is designed to return the water from the hose to the water tank. The pump is securely bolted to a support which lies upon the water tank and, like the latter, is firmly fastened to the wagon frame. The pump is driven by an intermediate gear, which, by means of a friction clutch, worked by a hand-wheel, engages the motor shaft. A three-cylinder pump working on cranks set at 120 deg., driven by a two-cylinder, four-cycle motor, accomplishes the greatest possible amount of work and throws a steady stream of water. With 90 revolutions of the pump shaft per minute, from 190 to 200 gallons, under a pressure of between six and seven atmospheres, may be thrown a distance of from 147 to 164 feet in the same time. In constructing the wagon frame, care nas been taken to make it as light as is consistent with the requirements. The water reservoir and the cooling water tank add much to the stability of the construction. The system of steering is the same as that used on most automobiles. Two brakes engage the rear wheels; one is worked from the driver's seat, and the other is a band brake applied by a foot lever on the engineer's platform. Four seats are provided in front, under which are a receptacle for tools and a hose reel, while the suction pipes are placed along the sides. Three lanterns serve to light the road. These, when the machine is at rest, may be removed and used elsewhere.



A GERMAN SELF-PROPELLED FIRE ENGINE DRIVEN BY A BENZINE MOTOR.

LONDON'S FIRST MOTOR FIRE ENGINE.

Speed, 30 miles per hour; horse power, 25; water tank, 25 gallons capacity.

The English fire engine, propelled by steam, is giving satisfaction. It is located at the Battersea fire station, and, when running to a fire, is capable of speeding up to 30 miles per hour. Because of its short wheel base, it can turn in less than 20 feet. The steering pivots are in the center of the hubs, in order to make the machine steer easily. A single boiler, of the vertical fire tube type, supplies steam for both the propelling and pumping engines, the former of which is of 25 horse power. The general arrangement and method of control can be seen at a glance from the illustration. The controlling levers are at the front, and the engineer simply attends to the boiler, which is fired by petroleum instead of coal. The machine was built at the headquarters of the Brigade at Southwark, and will doubtless be followed by other vehicles after it has had a sufficiently thorough testing to have shown its abilities.

Eating Ice.

The following thermodynamical problem is stated and solved by the Engineer: "A boy eats two ounces of ice. Let us see what is the approximately thermodynamic equivalent of the work he has made his interior do, assuming he takes five minutes to eat it. In melting the ice he will require 18 units to reduce it to water. To raise it in temperature to that of his inside he will require seven more units, or a total of 25 British thermal units. Taking the mechanical equivalent as 777 foot pounds, this will be equal to 19,425 foot pounds. If the boy weighs 100 pounds, he will have called upon his stomach to do as much heat work as would, with a machine having unit efficiency, raise him 194 feet high, or a rate of heat extraction equal to nearly an eighth of a horse power."

An Improved Automobile Steam Engine.

A new compound oscillating steam engine for automobiles is being perfected by Mr. Paul L. Crowe of this city. The improvements in this new engine consist in the reduction to a minimum of the number of bearings and other frictional surfaces; the use of very short ports, thus obtaining the minimum clearance; and the changeability of the engine from compound to simple or *vice versa*, by the simple manipulation of a valve. Engines of this type have been in successful operation for the past two or three years; and the inventor, in making some improvements to adapt it to steam carriages, has so constructed it as to make it readily adaptable to launches, hoisting outfits, or any other kind of work where a light, simple, and compact engine is desired.

Commissioner of Patents Allen will give a course of lectures during the winter on patent law and practice.

* A tank carried upon the engine, from which to supply the pumps, may be a revelation to those not conversant with European methods. A peculiarity of the above fire engine, which seems to be common to most appliances of this kind built on the other side, especially among the conservative Germans, is a water tank or reservoir, built under the wagon frame, from which the pumps take the water through suction pipes resting upon the bottom of the tank. The latter is intermittently supplied with water brought to it either in large casks on trucks or by means of a short hose, if a hydrant is within convenient reach. As yet the idea of connecting the pumps direct with a hydrant, and thereby affording a continuous supply of water with considerable initial pressure behind it, has not seemed to dawn upon their fire engineers. Some years ago, while at a fire in Vienna, where perhaps the greatest water supply system in the world exists, with a pressure of 75 pounds to the square inch, the writer remembers seeing several tenders, each consisting of a huge tun upon a four-wheeled truck drawn by two horses, running as fast as possible to and fro between a hydrant and a working engine which sucked its supply from an enormous tub or vat deposited on the ground beside it. A few seconds only were required to empty the tub, and a halt was called until more water should arrive. With a great commotion the cask-bearing truck pulled up beside the vat, a fireman, or properly speaking a waterman, deftly knocked out a huge bung or stopper, and with a gush the cask delivered its charge, and the engine was set to work for another minute to quench the fire.

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THE PARIS AUTOMOBILE SHOW.

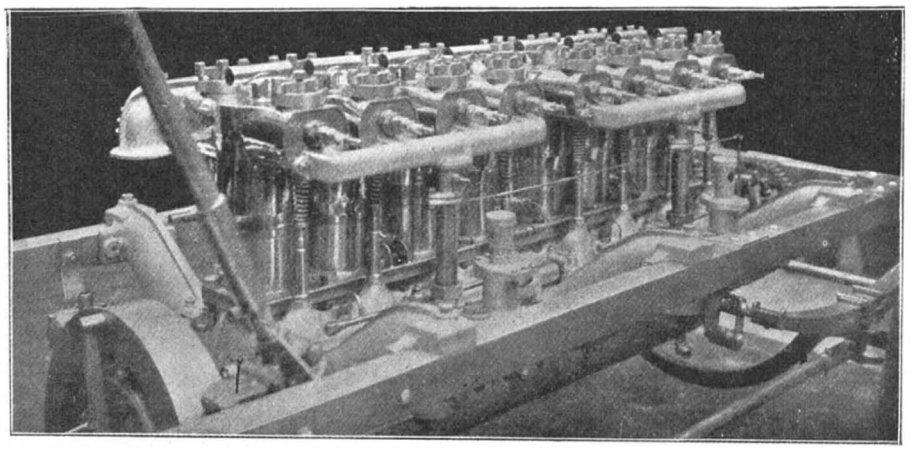
The fifth annual Exhibition of Automobiles, Cycles, and Sports, under the auspices of the Automobile Club of France, was held in Paris from December 10 to 24, and was, as heretofore, a decided success. Machines of Belgian, German, Italian, English, and American make were exhibited, besides a large assortment of standard French cars.

A machine that has met with great success the past year, and that has therefore been very widely copied, is the Mercedes, made by the Daimler Company of Cannstadt, Germany. The "beehive" radiator on this machine, at the front end of its long, coffin-shaped motor bonnet, the mechanically operated inlet valves, and the contact sparking device fed by current from a magneto, as well as the forced air circulation through the radiator by means of a fan in the flywheel of the motor, are the main features that have been adopted on many of the leading 1903 French machines. The magneto is more certain than batteries, but is not well adapted for use with a jump spark coil. Consequently make-and-break igniters are fitted, with their many moving parts outside and inside the cylinders to add to the complications. Mechanically operated inlet valves require an extra set of cams, and, where placed on the opposite side of the cylinders from the exhaust valves, an extra half-speed shaft for carrying the cams must be added. The only advantages claimed for such positively opened valves are that the engine can be run a little slower and is easier to start, there never being any trouble from sticking of the valves. In addition to throttling the mixture with an ordinary butterfly valve, on some machines the inlet valves are made to close early, thus limiting the quantity of charge drawn into their respective cylinders. One of the novelties of the show was the Kreb carbureter fitted on the new Panhard and Levassor three-cylinder motor. This device is so arranged that when the motor is running fast and the suction is strong, it takes its auxiliary air for the mixture through a special air valve between the carbureter and the motor. As the speed of the motor decreases, this valve closes proportionately, thus keeping the vacuum in the atomizing pipe of the carbureter always the same, and the jet of fuel raised by it constant. The atomizing pipe has a water jacket in which the warm water from the engine circulates, and the carbureter is also fitted with the usual throttle valve.

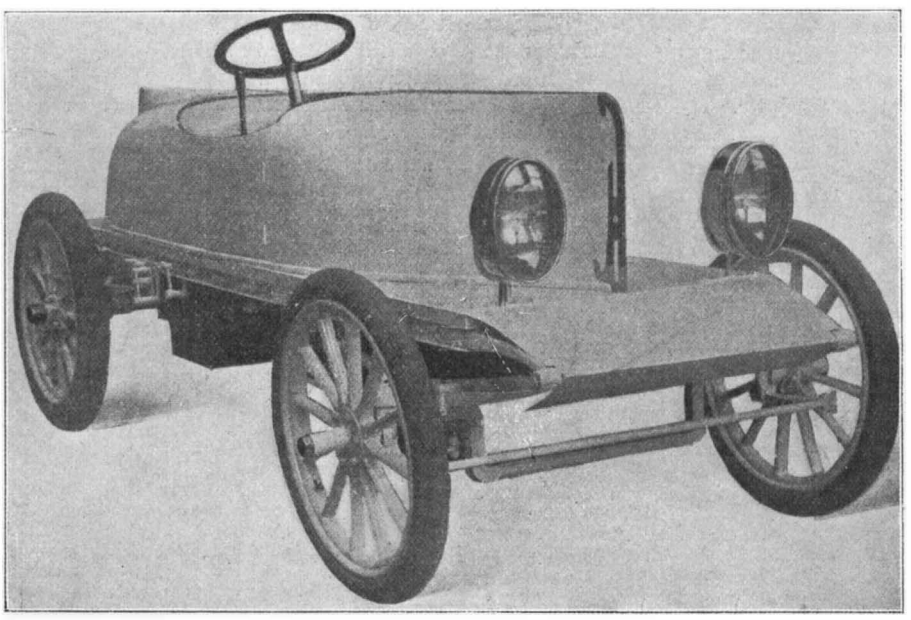
Most of the motors have their cylinders and water-jacketed heads cast in one piece. In some cases, where the cylinder jacket does not form part of the casting, aluminium or corrugated sheet-metal jackets are afterward slipped on the cylinder over the lower end.

A machine that attracted a great deal of attention was the new 40 horse power Serpollet steam racer. The body of this machine looks like a boat out of its element. The sharp prow and stern should cut through the air with the same ease, however, as does a similarly shaped hull through water. In the flash boiler of this car, the tubes, although fewer than usual, are longer, in order that the steam, while passing through them, may be thoroughly superheated. The water and fuel pumps are driven by variable cams, which may be changed at will by the driver, thus increasing or decreasing the quantity of water and fuel sent to the boiler and burner. Long side levers within easy reach of the driver serve to vary the eccentrics when necessary. Another decided novelty was the 40 horse power, eight cylinder, gasoline motor exhibited at the Charron, Giradot, and Voigt stand. This motor is to be used on a car fitted with but two forward speeds and a reverse. Very great flexibility by throttling is claimed for it, but whether this outweighs the complication of so many cylinders is a question. The sixteen valves are all mechanically actuated; but jump spark ignition is used, the designer evidently thinking there was enough to look after without complicated make-and-break apparatus.

A notable change in the construction of the frames for holding the machinery is seen in the abandonment of wood for light steel stampings or tubing of rectangular cross-section, with a wood core. The brakes are generally of the expanding and band type, working directly on the rear wheels, and the arrangement of the various levers is made as simple as possible; the small ones for controlling spark and mixture being placed on the steering wheel. Thus along general lines, the cars have been improved, although the additional parts on the engines tend to complicate rather than simplify this already sufficiently intricate piece of mechanism.



The Charron Giradot, and Voigt 40 H. P., 8-Cylinder Gasoline Automobile Motor.



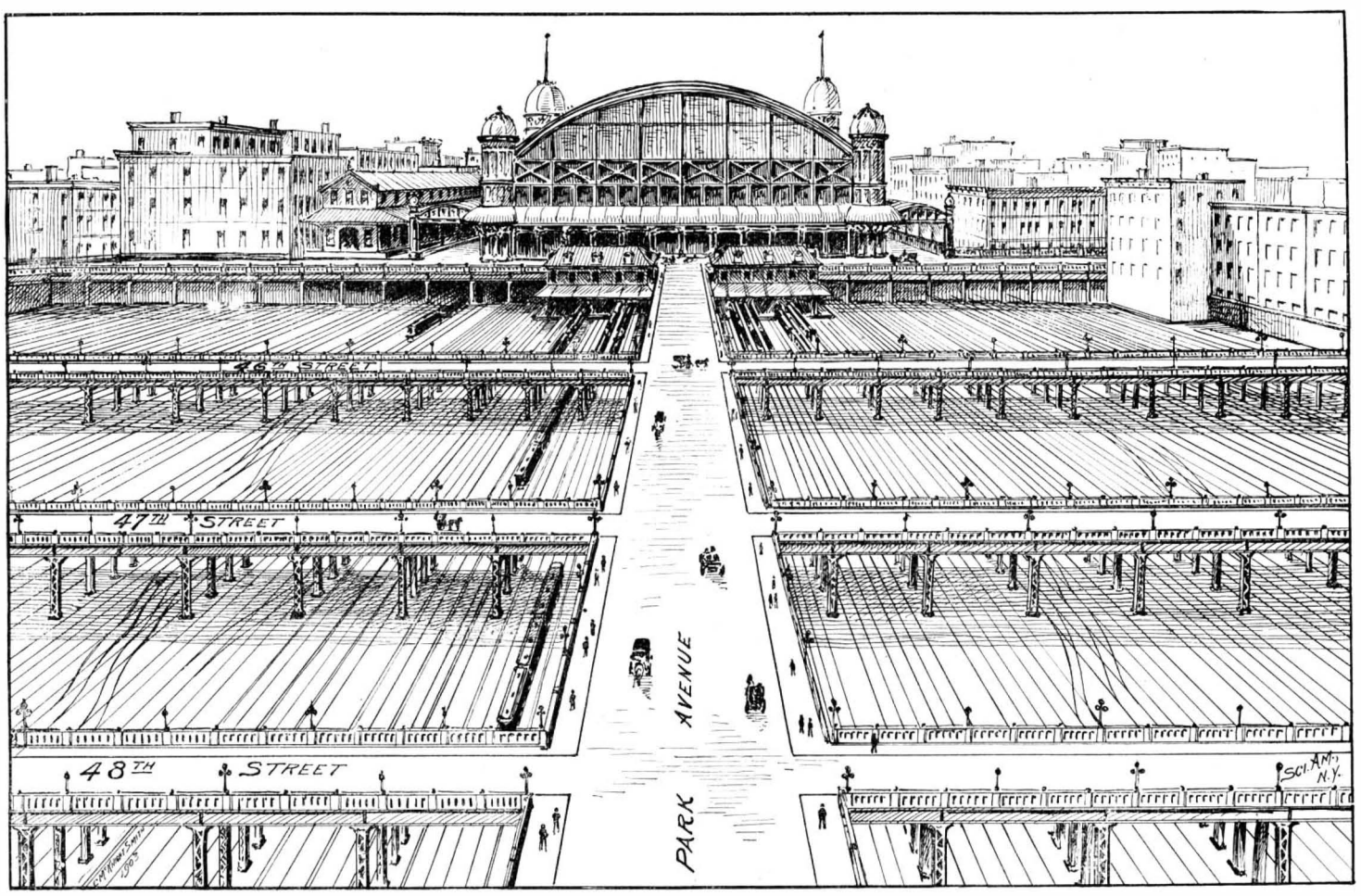
The New Serpollet Steam Racer.

GRAND CENTRAL STATION IMPROVEMENTS AND CONNECTION WITH RAPID TRANSIT SUBWAY.

As a result of the present co-operation of the New York Central Railroad Company with the city government, it is probable that a most extensive scheme for the improvement of the Grand Central terminal and the betterment of the notorious Park Avenue tunnel, will be inaugurated on the first anniversary of the shocking tunnel disaster of last February. There is a certain mournful satisfaction to be gathered from that tragedy, when we consider that it served to awaken both the company and the city to the necessity for making some most radical changes in the way of abolishing steam traction from the tunnel, and greatly enlarging the capacity of the yard and station, both of which were totally inadequate to handle the traffic.

At the very outset, the demands of the city for the improvement of the tunnel were met by the somewhat startling announcement that the charter by which it secured the use of Park Avenue, contained a clause restricting the Railroad Company to the use of steam traction therein. The necessary authority to enable the company to use electrical traction is now being sought at Albany.

The plan of improvement suggested by the Railroad Company, and modified by the city government, is on a most extensive scale, and will add enormously to the storage and general yard facilities of the terminal, besides greatly increasing the convenience of the terminal trainshed itself. At Fifty-sixth Street the Park Avenue cut, through which the present tracks run, will be widened so as to admit of three extra tracks on each side of the present four tracks, the ten tracks extending to Forty-ninth Street, where they will branch out into the present terminal yard. The switches for these tracks will be laid at Fifty-seventh Street, and here also the



View Looking South Along the Proposed Park Avenue Viaduct, Showing the New Cross-Street Viaducts, the Station Yard Below, and the North Face of the Grand Central Station.

RECONSTRUCTION OF THE GRAND CENTRAL STATION AND YARD.

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present grade will be lowered sufficiently to allow the cross streets to be carried on viaducts clear above the yard. Park Avenue itself will be extended as an elevated structure right through to the trainshed, and thus the whole system of streets will be restored in its entirety, and the property value and general convenience of the districts around the terminal yard will be, of course, greatly enhanced.

In the trainshed all the tracks will be lowered to 7½ feet below their present level, and 10½ feet below the floor of the concourse in front of the waiting room, which will be reached from each platform by easy gradients. At Forty-fifth Street, the carriage and wagon traffic will ascend by an easy gradient to a great plaza or driveway, located within the trainshed, and extending entirely around it, at a level which will clear the moving trains. Passengers will be driven with their baggage on to this plaza to the baggage room, where the baggage will be checked, and then to the concourse or waiting room, which will be at a slightly lower level. Similarly, incoming passengers will enter cabs or buses within the building. This great quadrangular plaza will provide ample room for all the cabs and other vehicles that come to the station, and the present crowding will be entirely avoided, the surrounding streets being relieved of much existing congestion. The present trainshed over the annex to the east of the station is to be replaced by an arched roof, similar to the one over the present trainshed, and the brick partition wall between the two sheds will be removed, thus throwing the two structures into one, and vastly improving the architectural and general appearance of the station. The main waiting room will be extended to Vanderbilt Avenue throughout the full width of the station front. The station yard is to be enlarged by extending it eastwardly to Lexington Avenue, with a view to affording additional storage tracks for trains.

In summing up, it may be said that the parallel tracks below Fifty-seventh Street will be increased 150 per cent, that the storage tracks in the yard will be doubled, as will also the capacity of the main waiting room in the station. The considerable increase in storage tracks will have the effect of rendering unnecessary the transfer of empty trains through the tunnel between Forty-second Street and Mott Haven, and from this cause alone the congestion in the tunnel will be greatly relieved. Furthermore, and the most important of all, the suburban service of the road is to be electrically equipped, and in all probability electric locomotives will be used for hauling the heavy main line trains through the tunnel.

CONNECTION WITH THE SUBWAY.

Our front page engraving shows one of the most important features of the proposed New York Central improvement, namely, the proposal to carry certain of the New York Central suburban tracks beneath the station to a connection with the Rapid Transit tracks under Park Avenue. As our readers are well aware, the four tracks of the Subway extend on an easy curve from Fourth Avenue westward into Forty-second Street. When the Rapid Transit engineers laid their plans, they saw the obvious advantage of making connection with the New York Central system, and the Rapid Transit Commission proposed several years ago to the company that this be made. The New York Central refused to entertain the proposition at that time; but the Rapid Transit engineers, foreseeing that the connection was demanded by the interests both of the city and the company itself, separated the tracks of the subway beneath Fourth Avenue, where they approach Forty-second Street, so that whenever connection should be determined upon, it would be possible to run the suburban and the Rapid Transit tracks together without having to put in any grade crossings, which latter would be a source of constant delay and peril to traffic. Although the plans for this connection have not been finally passed upon, we are enabled to present on our front page a drawing showing how the tracks will come in. The present Rapid Transit tracks are located a short distance below the street level, and cut through the northeast corner of the block, at Forty-second Street and Park Avenue, as shown. On this block is being erected a twenty-two story hotel, the most remarkable part of which, from a constructive point of view, is the huge excavation which has been made for the basement and sub-basements. After the excavations had been completed, a huge wall of concrete conforming to the curve of the inner wall of the tunnel was built up to the level of the subway tracks. Upon this will be placed a series of massive built-up steel columns, which will extend the full height of the tunnel, and from them to the northerly wall of the building will be laid a series of very heavy steel girders which will span the tunnel tracks, and carry the load of the northeast corner of the twenty-two story building. This work has called for some very nice calculations, as there is a total load of between 4,000 and 5,000 tons to be taken care of, the load on one of the columns being as high as 900 tons. The New York Central's connecting tracks will swing in beneath the Rapid Transit tracks, the two tracks for express traffic passing beneath and up between the Rapid Transit express tracks, and the downtown local track passing beneath the uptown local and the two express tracks, and rising to the surface between the south-bound express and the south-bound local tracks. By this arrangement all grade crossings at this point will be eliminated, a feature, as we have said, which is indispensable to the safe working of the system. As at present outlined, the New York Central proposes to run two express tracks to a connection with the express tracks of the subway; but this would mean that suburban passengers could land only at Twenty-third Street and Fourteenth Street on their way to the City Hall. By running in four tracks, it will be possible for suburban passengers to stop off at any local station below Forty-second Street that they may wish to. Now that the connection is to be made, there should be no half measures. The greatest convenience of the greatest number of passengers should be the object aimed at, and this can only be secured by providing a four-track connection between the New York Central and the Rapid Transit systems.

BUILDING OF COLUMBIAN UNIVERSITY MEDICAL DEPARTMENT, WHERE THE AMERICAN CHEMICAL SOCIETY MET.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY MARCUS BENJAMIN, PH.D.

The fifty-second annual meeting of the American Association for the Advancement of Science, which was convened in Washington city during the week of December 29, 1902, to January 3, 1903, now known as Convocation Week, proved to be "the largest scientific gathering ever held on this continent."

The opening session was held in St. Matthew's Church on Monday, December 29, at 10 o'clock, when President Hall, after calling the meeting to order, introduced as the presiding officer of the session Prof. Ira Remsen, president of the Johns Hopkins University, and known to science chiefly for his many researches in chemistry while filling the chair of that science in the university of which he is now the head. An address of welcome was made by Commissioner Henry B. F. McFarland, representing the government of the District of Columbia, who spoke of the government museums, libraries, and laboratories as worthy of the visitors' attention, and giving great promise of steady enrichment, both in the public and private scientific undertakings. He said: "We have in the national capital what must interest you as American citizens above anything that you can find elsewhere. This is the home of the national spirit, of the national flag, of the national government, incomparable in the wealth of its associations and memories and as a center of power and promise. Here the republic finds national expression, and from here confers national and international benefit in its world-round activities." On behalf of the national government, the members were welcomed by Dr. David J. Hill, Assistant Secretary of State, whose remarks pertaining to the scientific character of governmental work are most valuable. He said: "It has been owing to the demand of the scientific men of the country that our governmental work should rise to their apprehension of its needs, that we have at Washington a group of scientific experts of the highest character doing the work of the government in their special branches, and not mere bureaucrats held in their places by political influence. You will meet in Washington, in the employ of the government, men of the highest standing in their respective branches of science, recognized and honored by their colleagues throughout the country and throughout the world; not accepted as authorities because they are officials, but who have become officials because they were fine authorities. The other thought I wish to leave with you is the elevating effect upon the entire official staff of the government, exercised by the presence of acknowledged experts in its scientific branches. It has come to be generally accepted that no man should hold a public office unless he is specially qualified by his knowledge to discharge its duties with intelligence. We may easily insist too much upon mere academic standards; but specific qualification may well be made the test of fitness in every department of the public service." Dr. Charles D. Walcott, Director of the United States Geological Survey, representing the Washington Academy of Science and other scientific societies, welcomed the Association on behalf of the Local Committee, of which he was chairman. The President of Columbian University, Dr. Charles W. Needham, spoke for the educational institutions of Washington, saying: "It is fitting that these institutions should welcome the scientist. He discovers and gathers the facts and the laws which constitute in so large a part the knowledge which universities teach. It is science which gives us those facts, and a knowledge of those forces in nature and life which are the sure stepping stones upon which man rises to higher and nobler living." An acknowledgment was then made to these different addresses of welcome by President Remsen.

The ten sections and the affiliated societies then assembled in the rooms assigned to them in the buildings of the different sections of Columbian University and the United States Geological Survey, where they organized. Sectional committees and other officers of the sections were then chosen, who considered the titles of the papers submitted to them, and arranged them for publication in the daily program, after which the meetings of the sections adjourned until the following day.

During the afternoon the retiring addresses of several of the vice-presidents were read. Of these the more important were the following:

Prof. William S. Franklin, who holds the chair of physics and electrical engineering in Lehigh University, delivered a retiring address before the Section on Physics, entitled "Popular Science." His remarks began with a quotation from President Woodrow Wilson's address, given at the sesquicentennial celebration of Princeton University, when he said: "I am much mistaken if the scientific spirit of the age is not doing us a great disservice, working in us a certain great degeneracy. Science has bred in us a spirit of experiment and a contempt for the past; . . . yet I have no indictment against what Science has done; I have only a warning to utter against the atmosphere which has stolen from our laboratories into lecture rooms and into the general air of the world at large." . . . Science "has driven mystery out of the universe; it has made malleable stuff out of the hard world and laid it out in its elements upon the table of every classroom. Its own masters have known its limitations; they have stopped short at the confines of the physical universe; they have declined to reckon with

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spirit or with the stuffs of the mind, have eschewed sense and confined themselves to sensation. But their work has been so stupendous that all other men of all other studies have been set staring at their methods, imitating their way of thought, ogling their results." In discussing this he said: "Science does not need praise, nor does work need praise, they both need plain wages. I think it is time to urge a definition of Science which will help to purge the popular imagination: Science is the spirit of work. I do not mean the Spirit of a man who works, but I do mean simply that science has to do solely with the increasing efficiency of the sweaty labor of this world. I am little disposed to argue what many of you may be inclined to think an undue narrowness in this definition, but I assure you that it is wide enough for me.

"There is a tendency among reflecting men to confuse the boundaries between our logical constitutions and the objective realms which they represent to the understanding. Münsterberg thinks that this is the gravest danger of our time. I do not fully agree with this, but I do agree with President Wilson in seeing in this confusion of boundaries the effects of a noxious gas which has somehow got into the lungs of other men from out of the crevices of our workshops, a gas, it would seem, which forms only in the outer air and where men do not know the right use of their lungs.

"This confusion of boundaries is to my mind a new species of idolatry. The old idolatry is the worship of form, and this new idolatry is that contemplation of our logical constructions which despises objective constraint. Now, I cannot see that we, as scientists, are in any degree responsible for this disservice, this working of a great degeneracy among men, but, as individuals, I think most of us are guilty of more or less frequent and flagrant lapses of that submission to objective constraint which is the very essence of moral quality in scientific work.

"There is, of course, a legitimate sphere of scientific speculation of a certain kind, but the purely suggestive and highly tentative efforts in this line should not be confused with the more substantial work of science, and this is precisely what happens in the popular imagination. The majority of men do not appreciate the difference between a discussion of the motion of stars in the line of sight, based upon spectroscopic measurements, and a discussion of the habitation of Mars, based on nothing at all! Idle speculation is the last infirmity of strong minds, but it is certainly the first infirmity of weak ones, and popular science is, I think, primarily speculation.

"The extent to which some of our elementary text books in physics indulge in weak phases of speculation is very surprising to me, for, in this connection, it is absolutely out of place and entirely misleading. What do you think, for example, of the following quotation from Maxwell as a help to clear up an inadequate definition of energy in a secondary school book in Physics? 'We are acquainted with matter only as that which may have energy imparted to it from other matter, and which may in its turn communicate its energy to other matter. Energy, on the other hand, we know only as that which in all natural phenomena is continually passing from one portion of matter to another.' What do you think of the following, from an elementary English text book? 'The fundamental property of matter, which distinguishes it from the only other real thing in the universe, is inertia. . . We are now in a position to give one or two provisional definitions of matter—provisional, because we cannot yet say, possibly may never be able to say, what matter really is. It may be defined in terms of any of its distinctive characteristics. We may say that matter is that which possesses inertia, or, again, since we have no knowledge of energy except in association with matter, we may assert that matter is the vehicle of energy.' I wonder if any of you really doubt that every notion in physics, definite or indefinite, is associated with and derived from a physical operation, and that absolutely the only way to teach physics to young men is to direct their attention to that marvelous series of determining operations which bring to light those one to one correspondences which constitute the abstract facts of physical science. If you do, I am bound to say I do not think much of your knowledge of teaching of physics. I think that the sickliest notion of physics, even if a student gets it, is that it is 'the science of masses, molecules, and the ether.' And I think that the healthiest notion, even if a student does not wholly get it, is that physics is the science of the ways of taking hold of bodies and pushing them!"

Two public lectures, complimentary to the citizens of Washington, were presented by members of the Association. The first of these was on the Volcanoes of the West Indies, and was given by Prof. Israel C. Russell, who visited Martinique and adjacent islands at the time of the Mont Pelee disaster. The second was on King Solomon's Mines, or the Mines of Ophir, by Mr. John Hays Hammond, the distinguished mining engineer. Both of these lectures were illustrated by lantern slides and attracted considerable attention.

Two items of business of more than common interest are worthy of mention in this brief report. The first of these has reference to the death of Major Walter Reed, who, by solving the problem of the mode of spread of yellow fever not only made a great contribution to science, but at the same time conferred inestimable benefits upon his country and upon mankind. A suitable and permanent memorial of this great benefactor of his race was advocated, and a committee, consisting of the following members, was appointed by the president to take charge of the matter: Dr. D. C. Gilman, Dr. A. Graham Bell, Gen. George M. Sternberg, Mayor Seth Low, Hon. Abram S. Hewitt, President J. G. Schurman, Dr. S. E. Chaille, Dr. W. H. Welch, Dr. Charles S. Minot.

In addition to the foregoing, a resolution, asking that the President appoint as a member of the Isthmian Canal Commission a medical expert, so that special knowledge, based upon the practical familiarity with tropical diseases and experience in the application of sanitary measures, might be used to prevent the enormous loss of human life likely to occur from preventable diseases, particularly pernicious malaria and yellow fever.

The total attendance of the Washington meeting was 985, which makes it second only to the meeting held in Boston in 1880, when there were 997 persons present. An attempt was made to secure the number of persons in attendance at the meetings of the affiliated societies, and 363 of such registered, so that the attendance may be comparatively estimated at being not less than 1,500, which figures warranted the statement that "it was the largest gathering of scientific men ever held on this continent." There were 372 persons elected to membership, as well as a large number of members advanced to the grade of fellowship.

Following the practice of recent years, the invitation to meet in St. Louis, presented to the council at Pittsburg, was accepted, and it was voted to meet in that city during Convocation Week, 1903-4. The Hon. Carroll D. Wright, the well-known authority on economics, and a member of the recent strike commission created by President Roosevelt, was elected president, and Dr. Charles Wardwell Stiles, of the Marine Hospital Service, was chosen secretary. For further account of this meeting, the reader is referred to the current SUPPLEMENT.

The Current Supplement.

The English correspondent of the SCIENTIFIC AMERICAN opens the current SUPPLEMENT, No. 1411, with a discussion of the well-known Babcock-Wilcox boiler; his text is illustrated with photographic and sectional views. One of the most interesting features of the SUPPLEMENT is a diagram prepared by the Bureau of Naval Intelligence for the purpose of giving a graphic representation of the homogeneity of the different classes of battleships of the principal naval powers, the idea being to show at a glance how these navies are carrying out a plan of building ships in classes, keeping down, as far as possible, the number of different types. The canal problem of New York State is discussed in the light of Governor Odell's recent message. Mr. Marcus Benjamin gives an abstract of the proceedings of the fifty-second meeting of the American Association for the Advancement of Science.

The discussion of American methods of irrigation begun in the last SUPPLEMENT is continued.

A monument was recently unveiled with great ceremony, near Junction City, Kan., to mark the supposed site of the famed city of Quivira, which the natives of that section think lies buried beneath their feet. The obelisk is the contribution of the members of the Quivira Historical Society, who are scattered through Kansas, Minnesota and other Northwestern States, the leading spirits of which organization are J. V. Bower, of St. Paul, Minn., who claims to be the rediscoverer of Quivira, and Robert R. Henderson, of Junction City. The location and even the existence of Quivira has been an active subject of discussion for a hundred years, and much has been written on the subject. It has been located at different times at various places in Mexico, Arizona, and other parts of the Southwest, but this is the only location which can lay claim to a substantial monument to mark its supposed site. Those who doubt the existence of the "City of Gold," as Quivira is spoken of, say that the Indians who were supposed to have peopled the city, and who bore the same name, were the poorest tribe known to history.

An International Fire Exhibition will be held at Earl's Court, London, from May to October next. Besides fire extinguishing and life saving apparatus there will be exhibited examples of modern fire stations and water supplying plants and their equipment in every form, ambulance and hospital facilities for cities, salvage work, and insurance.

Correspondence.

Do Mussels Move?

To the Editor of the SCIENTIFIC AMERICAN:

I do not pose as a scientist, and yet the question: "Do Mussels Move?" that has been going the rounds of the country press, and has found its way into the SCIENTIFIC AMERICAN of this date, has both amused and surprised me—a Missouri boy—and I suppose has surprised all Missouri boys who have lived near a stream.

The smooth thin-shelled mussel lives in the streams on the sandy bottom. The corrugated heavy-shelled mussel lives in the mud and is the commercial mussel, i.e., the shell from which buttons are made.

Often in clear water one can see the smooth-shelled mussel on edge with a trail or track behind it that may extend one or six feet. The side opposite the hinge is slightly open, and the mussel protruding a quarter of an inch, is feeding. Its lips, belly or feet are corrugated like the belly of a snake, and with the exception of the mussel's movement being in a straight line, is identically the same, being propelled by contraction and expansion.

When a large stream is full and causes "back water" in the smaller streams, and then recedes rapidly, the life habits of the large, heavy mud mussel are just as easily seen.

When a mussel is moving, if it is picked up quickly and squeezed, it draws back into the shell, and a fine stream of water will be forced out, like the water from the tube of a muzzle-loading gun when being cleaned.

The iridescent coloring of the inner side of the thin-shelled mussel is as fine as that of any sea shell.

Monroe City, Mo., Jan. 3, 1903. R. F. HIXSON.

The Cause of Thunder.

To the Editor of the SCIENTIFIC AMERICAN:

At the risk of advancing a theory which may have been already proven by meteorologists, I wish to make a suggestion in regard to the cause of thunder.

Upon inquiry among the men with whom I am associated, I find that our various colleges have given us all practically the same instruction on this point, namely, that thunder is due to the closing up of a vacuum formed in the air by the passage of the lightning, supposedly owing to the violent mutual repulsion of similarly electrified molecules. If this is correct, we have only the pressure of the air at 15 pounds per square inch to account for the deafening roar of a thunder peal.

Furthermore, it is taught that the report of a gun is due to the concussion of the air rushing into the bore after being expelled by the explosion of the cartridge.

Would it not be more reasonable to suppose that thunder is due to intense heating of the gases along the line of the electric discharge, and the consequent conversion of any suspended moisture which may be present into steam at enormous pressure, the effect being that of a violent detonation or blow upon the surrounding air?

In the case of the gun, is it not easier to believe that the gases which escape from the muzzle at a pressure of from 5 to 15 tons to the square inch have more part in causing the loud report by the blow they strike on the air than the subsequent recoil of air into the bore at the insignificant pressure of 15 pounds.

Since the density of the air is nearly uniform, the teaching of the schools would seemingly render no explanation of the great variation in quality and volume of sound noticeable in almost every peal of thunder. Frequently there are three phases, the first a sharp crackle sometimes prolonged for nearly a second, the next a heavy rumble punctuated by periodic louder reports, and third, though not always, a single earth-shaking explosion.

Following my line of thought the crackling noise would be due to steam explosions on a small scale caused by slight electric discharges (possibly induced) which precede the main bolt. The second phase would be due to a series of overlapping steam explosions generated by the main bolt, the occasional louder reports being due to the belts of drier air traversed by the lightning, in which increased resistance would be encountered, the temperature and steam pressure increasing proportionately, despite the presence of less water particles. The final report would be loudest in case it occurs at the point of the flash nearest the observer, as in a vertical discharge from the clouds to the earth. When the charge passes from the earth to the clouds the nearest point in the flash would be its beginning, and the observer would hear a loud report followed by a series of lighter ones, as is frequently the case. When the flash leaps from cloud to cloud the thunder would be a long roll or series of concussions, indistinguishable, or nearly so in point of loudness.

ROBERT V. R. REYNOLDS, Assistant Forest Expert.
Silkhope, S. C., January 14, 1903.

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LEADING TYPES OF AMERICAN RACING AUTOMOBILES.

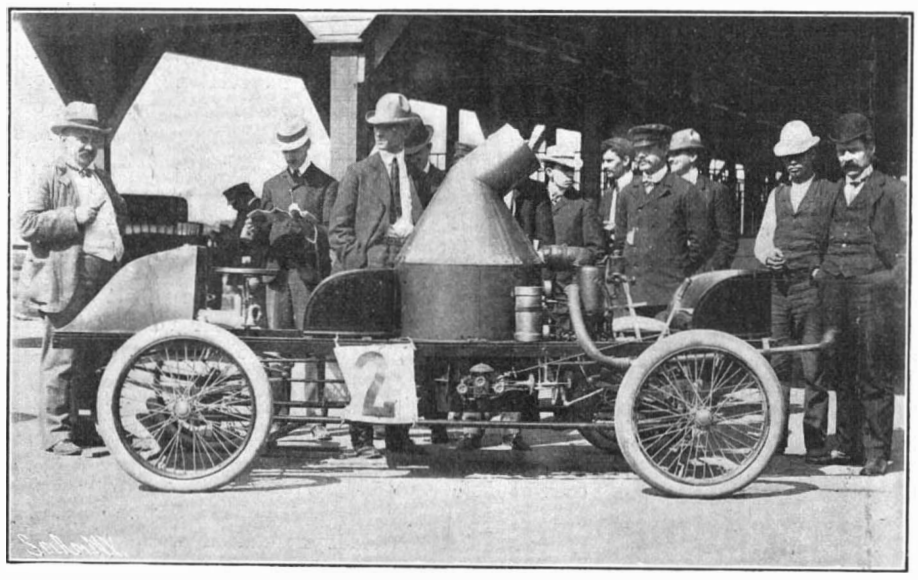
The automobile built for fast traveling, although decried by many as a worthless and dangerous toy, holds in reality the foremost place in the development of the new sport, for it is on these queer-looking, huge, and speedy machines that the parts which go to make up the luxurious touring cars of to-day are tried and proven. When once such parts have given satisfaction on a racer, the manufacturer can use them in assembling his regular machines with certainty of their furnishing reliable service. The French have led the way in this "tried and proven" method of perfecting automobiles, and, by holding the international Gordon Bennett cup race every year, have given the automobile builders of their fair land a chance to demonstrate to the world at large the speed and endurance qualities of their machines. Last year, for the first time, the cup was wrested from them by the English, who were represented by Mr. S. F. Edge in an English-built Napier car; and this year, if the experience gained in track racing the past two seasons counts for anything, our automobile enthusiasts hope that one man of the racing team they are sending to compete for it, will fetch the cup to America, upon his return.

A brief description of some of the machines that have made excellent track records during the past year will no doubt interest our readers. We have chosen, accordingly, a machine of each type—electric, steam, and gasoline—although, for long distance road racing, "gasoline is king" up to the present at least. The Baker electric road wagon, seen at the top of the page, after having undergone numerous track tests the past year, has become the standard 1903 model of this enterprising firm. The illustration shows Mr. Baker in the machine with which he covered a mile in 1:42 on the Detroit, Mich., track, the 24th of October last, and made a record of 17 minutes, 58 seconds for ten miles a day later. The improvements to be noted in this machine over the well known type of runabout, are the mounting of the motor longitudinally on the running gear, and the employment of a direct bevel gear drive, thus dispensing with a chain and its attendant troubles. The carriage is built heavier and stronger throughout, and is completed by a suitable top and mud-guards. It was equipped with all these fittings, as shown, when it made the record. Twelve cells of Gould storage batteries are used to propel the machine.

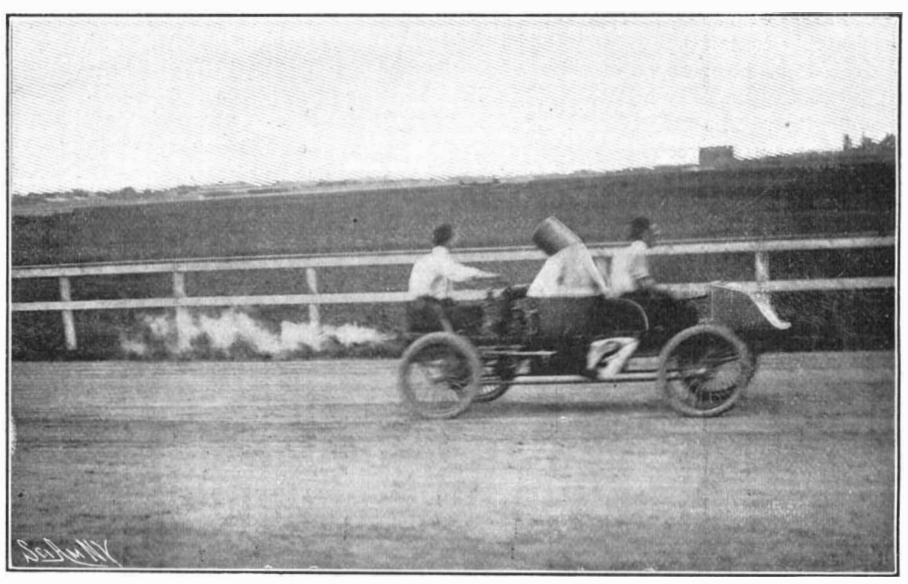
Mr. Walter C. Baker in His Gentleman's Electric Road Wagon.

The Cannon steam racer belongs in the same class as the Riker electric racer, which covered a straightaway mile in 1:03 on the Coney Island boulevard a year ago last fall, in that it is a racing machine pure and simple, designed for speed purposes merely, without the development of a commercial machine in view. It was built by Mr. George C. Cannon, a Harvard student, and, driven by him and T. C. Marsalis, has made some remarkable track records. In the Brighton Beach races, on the 23d of last August, it made a mile in 1:07⅘, thus reducing by more than half a minute the mile track record of 1:39 previously made by T. E. Griffin in a locomobile nearly a year before, while at Providence, R. I., a month later, it reduced its former time to 1:05¼, and covered five miles in 6 minutes, 5 seconds.

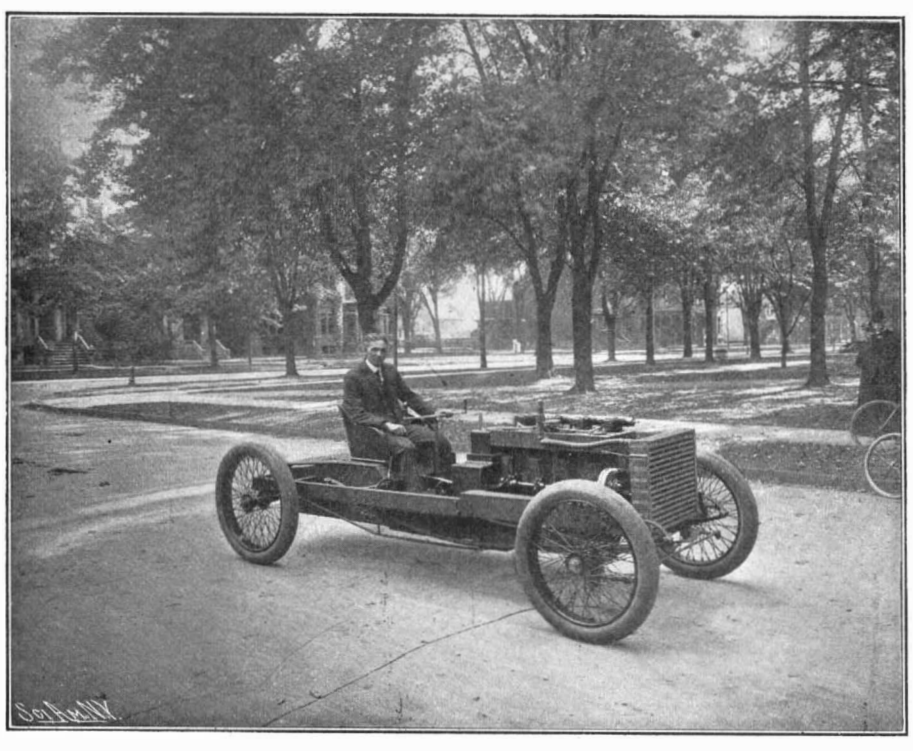
This racer, as can readily be seen from the photographs, is planned somewhat on the general lines of the Riker electric racer mentioned above. Like that machine, it has two seats—one for the steersman and one for the operator—but in this instance the power plant is situated between the two men. This consists of a 24-inch boiler and burner inclosed in an asbestos jacket an inch thick, which is held in place by a sheet-iron covering terminating at its top in a short smoke-stack, and bent forward at the bottom so as to form a scoop for giving a good draft when the machine is running fast. When making the records, the steam pressure obtained was over 400 pounds, and a pressure of 100 pounds was used in the gasoline tank for forcing the gasoline through the three spraying nozzles of the burner. Highly superheated steam was used in the engine, which is of the standard two-cylinder, 3½ x 4-inch, reciprocating type, situated just back of the boiler, and coupled direct by chain to the sprocket of the differential on the rear



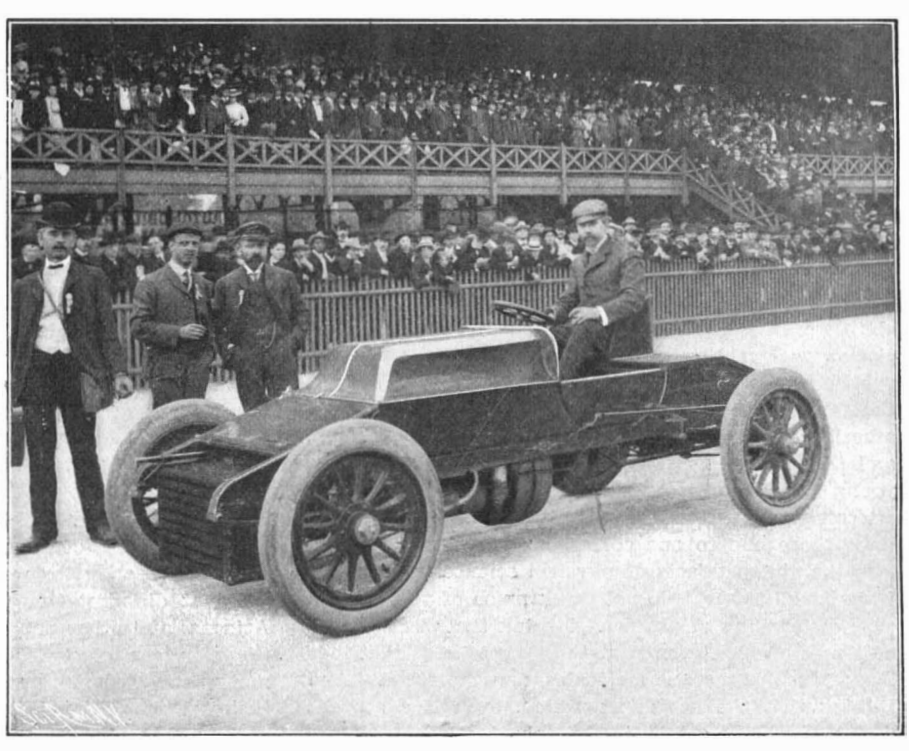
The Cannon Steam Racer.



The Cannon Racer Making a Record.



Henry Ford on His 70 Horse Power Gasoline Racer.



Alexander Winton in the "Bullet."

LEADING TYPES OF AMERICAN RACING AUTOMOBILES.

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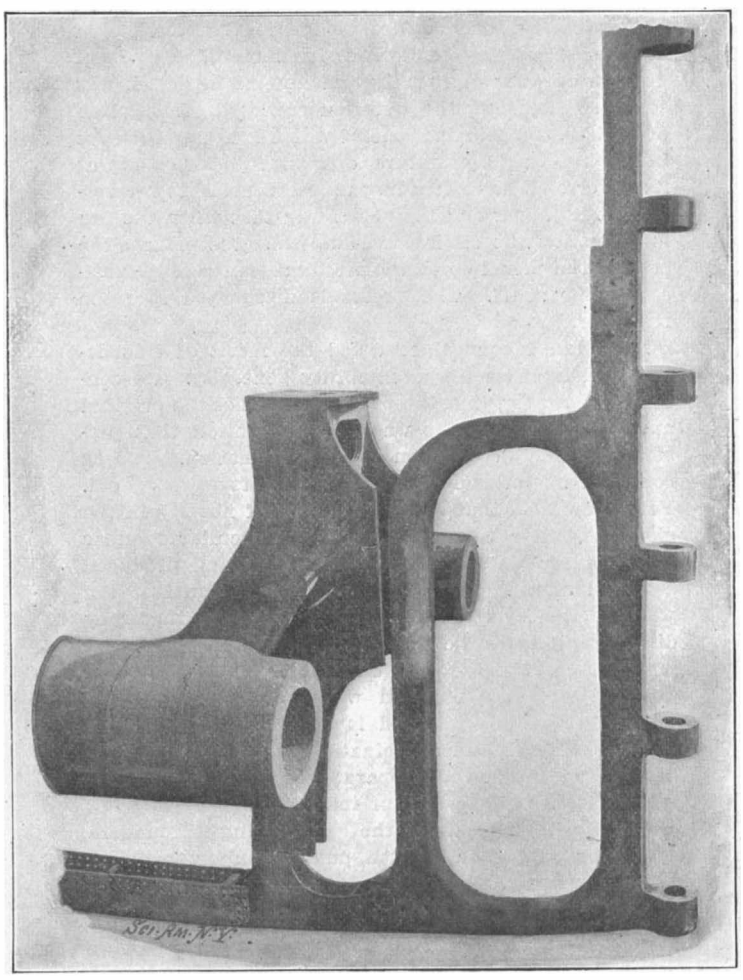
axle, no speed reduction being used. The water tank at the front has a capacity of 20 gallons. Directly behind it is the horizontal steering wheel, which is connected, by a system of universally jointed levers, with the steering arms of the front wheels. The exhaust pipe of the engine can be plainly seen curving around and protruding out back of the rear seat. The throttle and brake levers for controlling the car are also distinctly visible. Mr. Cannon built his racer with stock parts obtained from several automobile jobbers, and the fact that the results obtained with it were so satisfactory, speaks well for the material some of these firms are turning out. For a purely amateur construction, the machine has accomplished more in the way of record breaking than any other that has as yet appeared.

Coming now to the racers of the gasoline type, that built during the past year by Mr. Henry Ford, of Detroit, Mich., is one of the most striking examples of the latest tendency in racers. This machine, like Cannon's, was built as simply as possible, and without regard to appearance, the utilization of power to the best advantage being the chief aim of the builder. In order to accomplish this the differential gear has been dispensed with, and the motor drives the rear axle direct through bevel gears, with a speed reduction ratio of four to five, a 28-tooth bevel pinion on the main shaft meshing with a 35-tooth bevel gear on the rear axle. There are no change speed gears, but simply a flywheel clutch of the usual type, for disconnecting the motor from the wheels. These are stout wire ones, 34 and 36 inches in diameter, front and rear respectively. The wheel base of the car is 9 feet, 4 inches, and the tread 4 feet, 8½ inches. The main frame is made up of two 1⅝ x 4-inch side bars of white ash, lined with ⅛-inch steel plate, and bound together by three similar cross bars and two others of 4-inch channel iron, which support the motor. The side bars are trussed with steel rods, and the frame is braced laterally by a similar truss connecting the lower ends of the two steering knuckles. The frame is supported upon two semi-elliptical springs at the front end, but rests simply upon the bearings of the rear axle at the back. The motor used to propel this car is a vertical one having four 7 x 7-inch cylinders, cast integral, with cylinder heads and exhaust valve chambers thoroughly water jacketed. A separate exhaust pipe for each cylinder, with an area equal to that of the exhaust valve, conveys the burnt gases into the atmosphere. The inlet valves are automatic, being opened by the suction of the pistons only, and closed by a spring. A 2¼-inch gas supply pipe, connected to a single mixing valve, feeds all four cylinders. The gasoline tank for supplying this mixing valve is situated on the left of the engine. The water tank is under the driver's seat. The water is circulated by a gear-driven centrifugal pump, through 64 brass pipes, ¾-inch in diameter and 26 inches long, mounted on the front of the car. No radiating ribs are used. The crank-shaft of the motor is mounted in rigid bearings and is not incased, save for a tin cover hung beneath it to protect it from dirt and dust. The two center cranks are opposed to the two end ones, and an explosion occurs every half revolution in cylinders 1, 2, 4, and 3 respectively. On the end of the crank-shaft toward the rear of the car, keyed and fitted on a taper, is a 230-pound flywheel, 23 inches in diameter and 6 inches wide. A wooden block clutch is expanded, by means of levers, against the inside rim of the flywheel, thus locking the main driving shaft to the crank-shaft of the motor. The former shaft has no universal joints, but is rigidly aligned with the crank-shaft, and carries a sleeve bearing the clutch upon it.

The ignition outfit consists of a battery of five accumulators, which supply current for four Rhumkorff coils. A suitable commutator switches the primary current to the proper coil for each cylinder. The spark-lead-controlling lever is at the right of the driver's seat, while on the left of his seat is a thumb wheel for regulating the supply of gasoline. The clutch pedal is located in the center of the foot box, directly in front of the operator; another pedal on the left of this box governs the throttle valve; and a third pedal, on the right side, puts on the brake. The vertical steering post has a 28-inch cross arm, with vertical handles at each end. This arm is so connected to the steering arms of the front wheels as to give a leverage of four to twelve.

The Ford racer made a record (unofficial) of a mile in 1:01 1-5 on the Grosse Point track, Detroit, December 1, 1902. Its builder thinks it capable of still faster time than this, however; and, in the near future, hopes to make an even better record. The machine is looked upon as one of the possible competitors for the Gordon Bennett cup.

The Winton "Bullet" is similar in many respects to the machine just described. Its best track records were the mile in 1:02¼, on the Glenville track, Cleveland, September 16, 1902, and ten miles in 10 minutes, 50 seconds. The machine is no longer in existence, but its indefatigable builder is busily engaged in constructing a new and still faster one, in which he will return to the use of his well-known horizontal motor. The new machine is already entered in the international cup race of 1903. Several other manufacturers throughout the country are building special machines, and, after a number of trial races have been held, the best three racers will be chosen to represent America in the contest next summer.

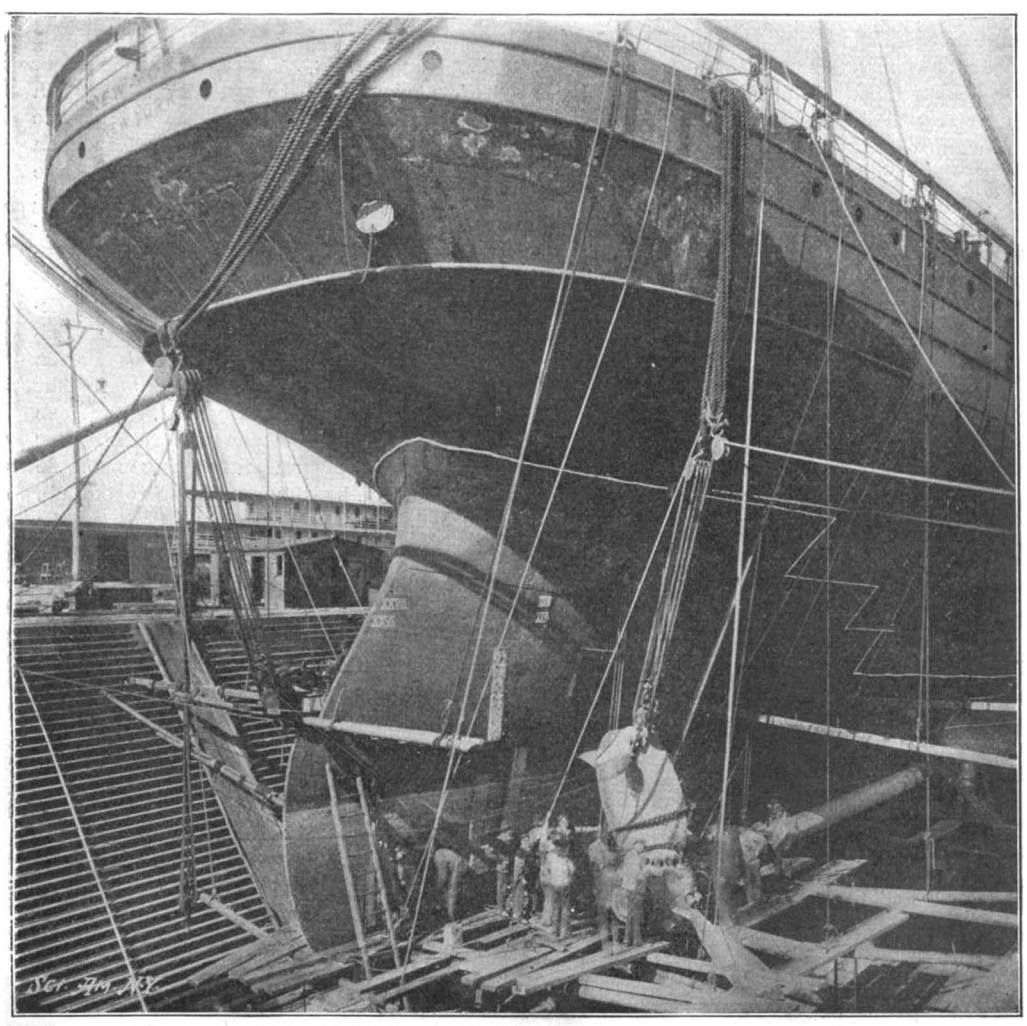


THE STEEL CASTINGS FOR NEW STERN OF STEAMER "NEW YORK." SPECTACLE FRAME, 38 TONS; STERN FRAME, 32 TONS.

Shown as assembled ready for plating in.

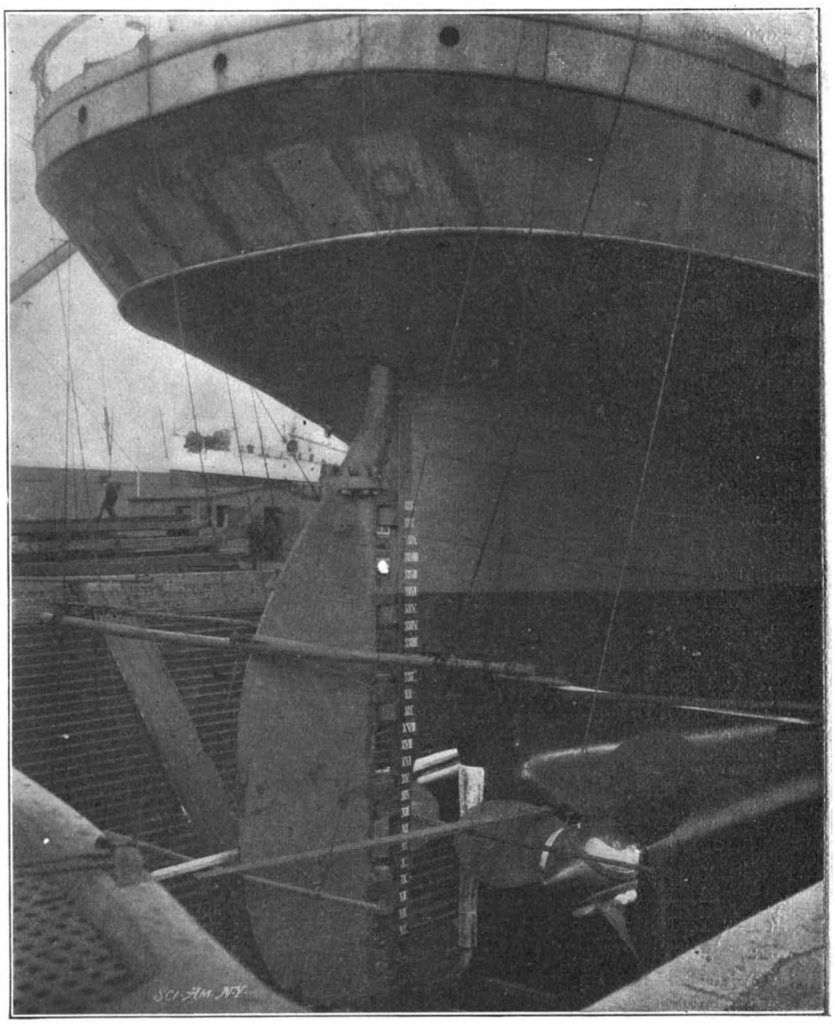
RECONSTRUCTION OF THE STEAMSHIP "NEW YORK"

There has lately been carried through at the Erie Basin drydock, Brooklyn, a most important work of reconstruction on one of the notable steamships of the world, the "New York" of the American Line, formerly the "City of New York" of the Inman and International Line. This vessel, with her sister, the "City of Paris," now the "Philadelphia" of the International Navigation Company, was built in 1889 and was the first of the modern, twin-screw, high-speed, transatlantic liners. The two vessels broke the transatlantic record early in their career, and were about as famous a pair of ships as were ever seen on the high seas. After their transfer



THE OLD STERN AND BALANCED RUDDER OF THE "NEW YORK" BEFORE RECONSTRUCTION.

The white line on plating shows the portion which was rebuilt.



THE NEW STERN, PROPELLER SHAFT HOUSING, AND RUDDER COMPLETED.

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to the American Line, now incorporated in the International Navigation Company, they were named the "New York" and the "Paris." They were in active service during the Spanish-American war as government scouts, work for which their large coal capacity and high speed rendered them very serviceable. Shortly after the conclusion of the war, when they were again in the Atlantic service the "Paris" ran ashore on the south coast of England and remained on the rocks for several months. Ultimately she was floated by a German salvage company, and taken to an English shipbuilding yard, where her bottom, which had been badly broken up, was entirely rebuilt, the hull generally strengthened, and new engines and propellers put in place, the old triple-expansion engines being replaced by modern quadruple-expansion engines, and new batteries of boilers, carrying much higher boiler pressures, installed. The vessel was re-named the "Philadelphia;" and as the result of these changes, not only has an additional knot an hour been added to the speed, increasing it from a sea speed of 19 to 20 knots, but the increased speed has been gained with a considerable reduction of coal consumption.

About eighteen months ago the sister ship "New York," which forms the subject of our illustration, was taken in hand by the John N. Robins Company at the Erie Basin drydock, Brooklyn, for a similar overhauling and reconstruction. By the courtesy of Mr. W. D. Dickie, the general manager, we are enabled to present the accompanying illustrations and particulars of this interesting work. Two of our illustrations show the structural changes which have been made in the stern and propellers of the ship, one of them representing the vessel when she was first put in drydock, and the other being taken when the work was completed, and shortly before the vessel was floated. The first step was to remove the plating and frames over that portion of the hull which is indicated by the zigzag white line in our engraving. It will be seen that, as originally constructed, the vessel was fitted with a balanced rudder, which was carried entirely below the water line, the sternpost being built out astern and the structure of the ship being here swelled out to admit the rudder head and permit the placing of the steering gear within the swelled-out portion and below the water line; this being done because the vessels were built with a view to use by the British government as armed cruisers, the government requirements calling for below-water steering gear. After the removal of the plating and framing the heavy steel castings of the spectacle frame and the stern frame, weighing together some 70 tons, were put in place; the frames which, in their lower portion, were curved out to form the housing for the propeller shafting, were set up; the structure was plated in; the massive rudder, which is a single steel casting, was hung; the rudder head bolted on; and the job, as far as the stern was concerned, was completed. Under the old arrangement the tail shafts were exposed, and their weight and that of the propellers was supported on heavy shaft-brackets, a system of construction which was in vogue when the vessels were first built. Now, as will be seen from the engraving, the shafting is completely inclosed up to the propeller hubs, and a much stronger construction is secured, while the shafting is protected from the water, and may be at any time inspected from the interior of the ship. Each propeller-hub weighs 13,500 pounds, and the three blades weigh 28,300 pounds.

At the same time a vast amount of new steel work was built into the hull itself, the total for the whole ship reaching 2,200 tons. The hull was carefully gone over, and the butt straps were replaced by new ones. An entirely new engine foundation was constructed, the arrangement of the decks was altered, some of them being almost entirely rebuilt, and new water tanks were put in. The new propellers, it should be mentioned, are placed one foot six inches nearer to the center line of the vessel than the old propellers. They are also somewhat smaller in diameter, and a higher rotative speed will be used with the new quadruple-expansion engines. At the completion of the repairs the vessel was floated out of drydock and towed to the Cramp's shipyard, Philadelphia, where the engines and boilers will be installed. It should be mentioned that when she leaves the Cramp's yard she will differ materially in appearance from the old "City of New York," the three funnels which were a conspicuous feature in the vessel being removed, and two single funnels of greater height being put in their place. It is interesting to note that this is considerably the largest job of the kind ever undertaken at the port of New York, and its successful completion serves to indicate the material progress that is being made in shipbuilding construction in this neighborhood.

Charles L. Murray, a San Francisco fireman, has a claim against the city for the use of a draught-regulating device for use on vehicles which are drawn by three horses. The City Attorney has rendered a decision supporting his demand for remuneration. The apparatus is in general use in that city.

Legal Notes.

New Combination of Old Elements.—A suit was recently brought by the Emerson Electric Manufacturing Company against the Van Nort Brothers Electric Company (116 Fed. Rep. 974) to restrain the infringement of certain claims of letters patent for an improvement in lubricating bearings designed especially for use in connection with electric ceiling-fan motors. The usual defense of want of novelty and non-infringement was set up. The patent in question covers a combination of devices, the principal one of which is a spiral groove in the hub of the armature, opening into an oil-cup at its lower end, and extending up the bearing to a reservoir at its upper end in such a way that when the fan is in motion the oil is forced up the groove from the cup on the principle of the Archimedean screw, lubricating the shaft. The excess is discharged into the reservoir.

Defendant's counsel conceded the merit of this device and likewise its patentability generally. He contended, however, that the patentee was not the original and first inventor. It was this contention that presented the main question for determination. It was conceded by the court that the elements were all old. Yet it was held that despite the lack of novelty in the elements, their combination in the peculiar manner provided for by the patentee was new and produced a useful result. The court proceeded to analyze the patents cited by the defendants and showed that they did not anticipate the patent under which complainant manufactured. The court cited the case of Bates vs. Coe (98 U. S. 31, 48), in which it was remarked: "Where the thing patented is an entirety, consisting of a single device or combination of old elements incapable of division or separate use, the respondent cannot escape the charge of infringement by alleging or proving that a part of the entire thing is found in one prior patent or printed publication or machine, and another part in another prior exhibit, and still another part in a third one, and from the three, or any greater number of such exhibits, draw the conclusion that the patentee is not the original and first inventor of the patented improvement."

The invention under consideration is the combination in one device of elements alleged to have been all shown by prior patents so as to produce a new and useful result, or at least to produce the old result in a more facile, economical and efficient way. If the combination produces such results by the joint and cooperative action of the elements combined, even if they are old, it is invention within the meaning of the patent law, notwithstanding the fact that each of the elements separately considered, or in other combinations, were old and well-known in the art.

The record in the case showed that considerable progress had been made in the art of lubricating vertical shafts before complainant's patent was granted. One inventor had discovered the utility of the revolving oil cup; another had discovered the utility of the ball-bearing; another had discovered the utility of the spiral groove; and these different elements had been separately employed, or one had been combined with another in such a way as to produce certain results. But in the court's opinion no one had discovered the combination covered in the claims in this case, prior to complainant's patent. That patent gave the finishing touch to former crude beginnings. The inventor brought success out of comparative failure, produced a combination not only practically new in itself, but produced new and very beneficial results. A decree was entered for the complainant.

The Weston Electrical Instrument Case.—The Weston Electrical Instrument Company brought an action in equity against J. F. Stevens and Elmer P. Morris of the Keystone Electrical Instrument Co. to restrain the alleged infringement of letters patent granted to Edward Weston for electrical measuring instruments. Judge Coxe in the United States Circuit Court of the Southern District of New York, before whom the case was heard, gave it as his opinion that there were certain fundamental propositions which, if not admitted, could not be successfully disputed. Mr. Weston was the first, he thought, to make a successful commercial voltmeter for measuring alternating currents.

Strictly speaking, there was no prior art. If the invention be confined to alternating current devices, it can be said with confidence that there were no practical commercial instruments prior to Weston's. Hence, there were no instruments entitled to be considered as anticipations. There were two or three instruments which, as scientific possibilities, could, it is true, reach accurate results; but as every-day working devices they were of little value. The most satisfactory of these were, perhaps, the Thomson balance, invented by Lord Kelvin, the Siemens dynamometer, and the Cardew hot-wire voltmeter. There were other instruments, but they were no nearer to the invention than those referred to. As Judge Coxe expressed it, "they have about the same relation to the Watson device as a medieval crossbow has to a modern repeating rifle." In the Court's opinion, infringement was clear. The defendants copied the patented instrument even in its minute details. The only difference entitled to notice is the substitution of a V-shaped spring for the upper flat spiral spring of the patent. The two springs are unquestionably equivalents. This was a case where upon undisputed testimony the inventor had accomplished something which has been of unquestionable benefit. "In an art crowded with indefatigable and brilliant enthusiasts, he has made the only successful alternating current voltmeter in use at the present day." The claimant was granted the usual decree for an injunction and an accounting.

Limitation of Claims by Language Used.—In delivering his opinion in the case of Schreiber and Conchar Manufacturing Company vs. Adams Company (117 Fed. Rep. 830), on appeal, District Judge Lochren showed how claims should be construed and limited. The subject matter in dispute was the validity of the Farwell patent for an adjustable stove-damper. The evidence showed that the business of making adjustable stove-dampers, to be used in repairing stoves and renewing disabled dampers, was so considerable that many devices were invented and in use, some of which were patented. In all, the object was to provide a damper which, without the exercise of special skill, could be fitted and adjusted to any ordinary cooking stove. The Farwell patent was granted for its peculiar combination of constituent parts. These parts separately considered were old. Prior patents showed in many respects similar devices, but the Farwell patent was limited, not only by the prior art, but by the specific language of its claims, to a damper with a rod having two grooves in it, one on each side, extending nearly its entire length. The damper invented by Ohnemus and Sanner, and made by the defendant, performed the same functions as the Farwell device and in substantially the same way. The defendant's rod had no groove in it. It may be that Farwell's invention would have entitled him to take a broader claim than he did; but his patent makes no such broad claim. The language employed in the Farwell patent, as well in the specifications as in each of the claims, makes the rod of the peculiar form described, with two grooves an important and essential part, or the element of his combination. The defendant did not use a rod with grooves and was therefore held not to have infringed.

Contributory Infringement.—The case of Palmer vs. Landphere (118 Fed. Rep. 52) is interesting for the example which it contains of contributory infringement.

The letters patent, upon which the suit was based, were two, issued on December 9, 1884, to Frank L. Palmer and William H. Palmer for quilting machines. The defendant contended that after he had left the employ of plaintiffs he had a right to enter the employ of a rival and to equip its plant with the patented machines. He further maintained that he could continue shifting his employment, and in each case of new service furnish his personal knowledge in defiance of the patents sued upon. The Court found that the defendant was without question selling the different articles which entered into the construction of the infringing machines, at a profit.

During his original employment he learned the details of the quilting business, and with that knowledge he went forth into the world. Starting with a place of business of his own, the Court found that he left marks of his unfair methods behind, in various places. The Court declared that he was retailing at a profit separate parts of an infringing machine which he was employed by the purchaser to set up, and cannot avoid liability as a contributory infringer on the ground that he was merely selling his labor as a skilled workman.

The Patent Office has decided that President Roosevelt's name should not be used as an advertising trademark. In the opinion of the Commissioner of Patents a living celebrity is entitled to protection from the use of his name for the purposes of trade by others, and this is specially true in the case of the President of the United States.

Oral Agreements to Sell Patents.—In the case of Cook vs. Sterling Electric Company (118 Fed. Rep. 45), District Judge Baker held that an oral agreement for the sale of an invention, founded on a sufficient consideration, made pending an application for a patent, is invalid in equity and constitutes a good defense to a suit in equity, for infringement, brought by the inventor against the purchaser, after the issuance of a patent.

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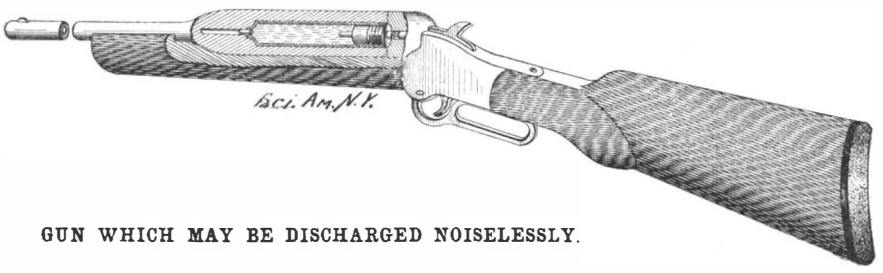
Patent Department

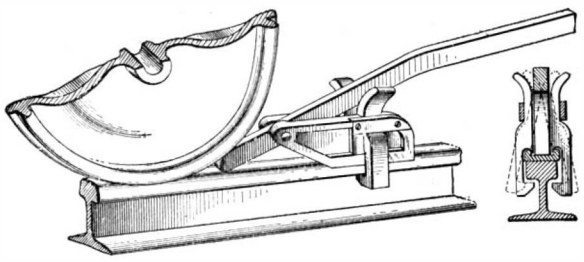
ODDITIES IN INVENTION.

MEANS FOR EFFECTING NOISELESS DISCHARGE OF GUNS.—In the gun here illustrated a sudden expansion of the gases at the muzzle is prevented, thereby insuring a noiseless discharge. This is accomplished by interposing a liquid between the projectile and the powder charge. The liquid will serve to prevent or retard the escape of the gases, and thereby avoid the violent and sudden displacement of air. The gun barrel is provided with a piston chamber in which a piston is adapted to slide. Back of the piston is a shell which contains the powder charge. Between the piston and the projectile is sufficient liquid to at least fill the barrel of the gun, so that the projectile will be subjected constantly to a propulsive force until it passes from the barrel. All the parts may be contained in the cartridge, which will be handled in the usual manner. When the charge has been fired, the liquid serves first as a packing to prevent the escape of the gases generated. When the piston has reached the end of the cartridge the escape of the gases is controlled by a teat on the piston, which projects into the barrel. The gases are thus checked, and permitted but a slow flow through the barrel.



GUN WHICH MAY BE DISCHARGED NOISELESSLY.

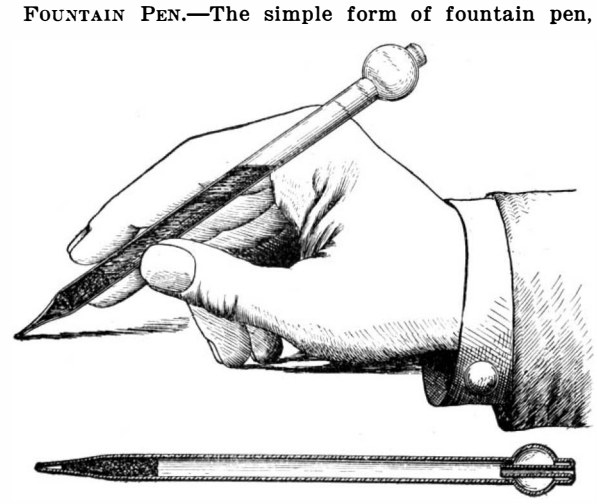
CAR MOVER.—A new device for moving cars has been invented by Messrs. H. C. Harrington and W. M. Towers, of Rome, Ga. It comprises a body portion between the arms of which the car moving lever is mounted. Two clamping devices are hinged to the side walls of the body portion. The upper ends of the clamping devices are turned outwardly from each other and at their lower ends they are provided with jaws. In operation the car mover is arranged on a track rail by moving the lever



CAR MOVER.

upwardly out of contact with the upper ends of the clamping devices as shown in dotted lines in the detail illustration. In this position with the flat base of the body portion resting on the rail the device is slid along until the forward end of the lever is moved well under the car wheel. Downward pressure is now exerted on outer end of the lever which serves to spread apart the upper ends of the clamping devices, thus causing the jaws to grip the head of the rail. With the car mover locked against rearward movement and the forward end of the lever under the wheel, continued downward movement of the free end of the lever will push the car wheel forward until the lever reaches the end of its stroke. The jaws are then released by raising the lever and the device may be moved forward to repeat the operation if desired.

FOUNTAIN PEN.—The simple form of fountain pen, here illustrated, was designed with a view of producing an effective yet inexpensive instrument which could be readily filled with ink and which, when in inverted position in the pocket, would prevent leakage of the ink. The pen consists of an ink-holding barrel pointed at one end and provided at the other with a bulb into which a capillary tube projects. This tube forms an opening into the pen through which air can enter the chamber when the pen is in use and permit an even flow of the writing fluid through the small opening at the writing point. To fill the pen the point is inserted into the ink and suction is applied to the opposite end of the barrel. To prevent too rapid feed of the ink through the channel a packing of hygroscopic material, such as absorbent cotton, is placed in the barrel near the writing point. This packing, while permitting the barrel to be filled on the application of a vacuum, will also retard and control the flow of ink through the channel in the writing point.



A SIMPLE FOUNTAIN PEN.

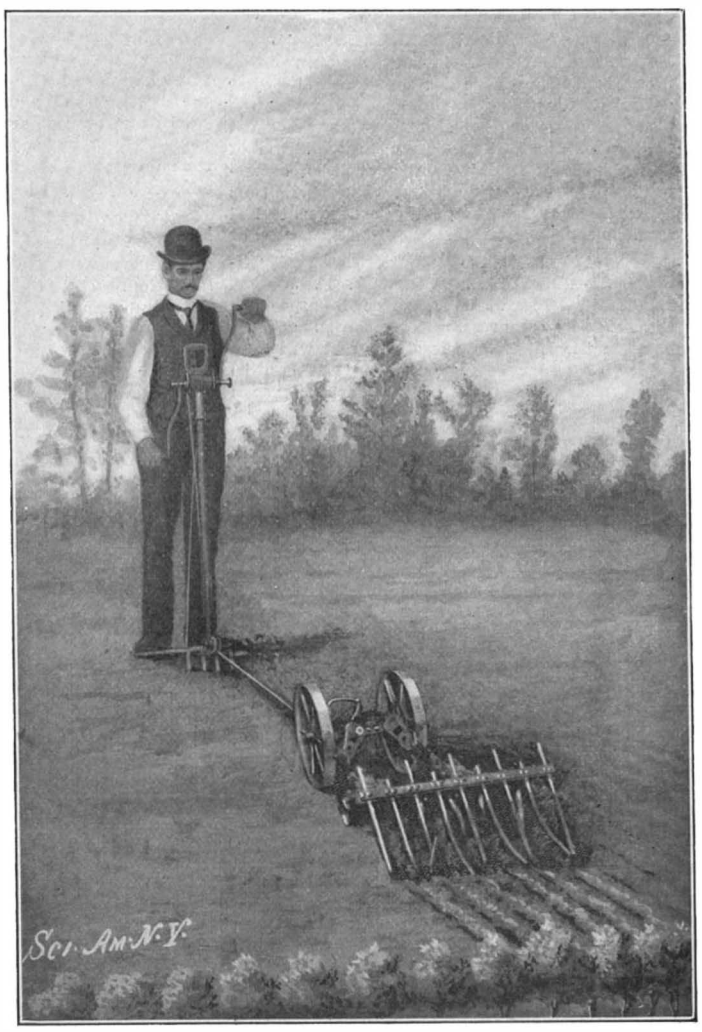
ELECTRIC SWEATING-ROBE.—Among the recent inventions in medical apparatus is a sweating-robe heated by electricity for the treatment of such diseases as are susceptible to the influence of electricity applied

ELECTRIC SWEATING ROBE.

in the form of heat. The robe is made of two layers sewed together. A resistance wire arranged in zigzag folds is interposed between these layers. When in use the patient is wrapped in this robe, and a current of proper strength is passed through the resistance wire to generate heat. The arrangement of the wire poles is such as to evenly distribute the heat throughout the robe. By regulating the current varying degrees of heat may be obtained. On account of the zigzag disposition of the resistance wire, the robe may be readily rolled up into a small bundle.

PORTABLE POWER DEVICE FOR FARM WORK

Notwithstanding the great advances already made in agricultural machinery, it is a fact that a great deal of the work on a farm, more particularly a truck farm, can be done only by the use of hand implements. The hand cultivator is particularly racking to the muscles because requiring, as it does, more than a single man's strength to force it steadily forward through the ground, the only way of operating it at all is by a series of intermittent forward pushes or blows, in which sufficient momentum is obtained at each push to hammer the hoe blades along through the ground. Obviously, then, more work could be done if the device were drawn steadily forward by means of a power-multiplying device. In order to be of practical value this device must be light, so that it can be easily carried about, and it must also be provided with an anchoring means by which it may be readily and quickly made fast. We illustrate an ingenious implement invented by Mr. David Lubin, of 278 West 113th Street, New York city, which was designed to meet the conditions above laid down. It consists of a winding drum and crank mounted on the upper end of a common fork. The tines of the fork, when buried in the ground, serve as an anchor, and the stability of the implement is further insured by a brace, which extends downward from the back of the fork handle and terminates in a light platform on which the operator stands. The weight of the operator is thus used to good advantage, and an anchorage may be readily obtained which will stand up under a considerable pull, especially since the rope, which draws the cultivator, runs under a pulley close to the ground, before passing up to the winding drum. Our illustration shows the device in operation, drawing a small cultivator along the ground. In a recent test it was found that a hand cultivator of this make broke up an area of 28 square feet to a depth of 3 inches in 11½ seconds, figures that indicate the waste of energy due to the chopping operation of a hoe or the hammering motion of an ordinary hand cultivator. With the improved method the cut follows a straight line and is of a uniform depth and width; and as the operator precedes instead of following the machine, there is no treading on and repacking the earth just broken. No experience is required to operate the device, and a farmer need have no apprehension lest his plants be hacked to pieces through the carelessness of some green hand. The implement can, of course, be so geared as to operate with but slight effort on the part of the operator, and should prove useful even for women in the care of their flower gardens.



PORTABLE POWER DEVICE FOR FARM WORK.

Extensions of Manufacturing Time on Canadian Patents.

It has been the practice of the Canadian Patent Office to grant extensions of manufacturing time on Canadian patents from year to year under section 37, subsec. (a) of the Canadian Patent Act, which reads: "That such patent and all the rights and privileges thereby granted shall cease and determine, and that the patent shall be null and void at the end of two years from the date thereof, unless the patentee or his legal representatives, or his assignee, within that period or any authorized extension thereof, commence, and after such commencement, continuously carry on in Canada, the construction or manufacture of the invention patented, in such a manner that any person desiring to use it may obtain it, or cause it to be made for him at a reasonable price, at some manufactory or establishment for making or constructing it in Canada." But in the decision in the recent case of Power vs. Griffin it was held that the Canadian Commissioner of Patents exceeds his authority in granting a second extension of manufacturing time; for, having granted one extension, he has reached the limit of his authority, and is without power to grant further extensions.

In the case at bar, the facts show that the Canadian patent was granted on August 11, 1899, and that on June 8, 1901, an extension of one year was granted from August 11, 1901, in which to commence the manufacture in Canada. This extension was held to be valid and within the powers vested in the Commissioner. In May, 1902, a second extension of manufacturing time was granted, but the Chief Justice held that having once exercised the power given to him by the statute, the Commissioner was *functus officio*. The Commissioner might have extended the time for more than one year, but he could not twice exercise

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the same power. The court was willing to remit the case back to the Exchequer Court, in order to give the patentee an opportunity to show that he had commenced the manufacture of the invention in Canada before the expiration of the first extension, although his counsel had failed to plead it in the lower court, and in the application for the second extension it was admitted that the patentee would be unable to commence the manufacture before the expiration of the first extension. It was held that when suing for infringement it was necessary for the patentee to show that he had commenced the manufacture in Canada within two years of the grant of the patent or before the expiration of a single extension of manufacturing time. In no case is the Commissioner empowered to grant the extension of manufacturing time for more than two years, and the manufacture should therefore be commenced within four years of the grant of the Canadian patent, under the most favorable circumstances. In several early cases it was held that as the declaring of a patent invalid because of non-manufacture was in the nature of a penalty, it should not be done except when the Canadian public had suffered because of the failure to commence the manufacture in Canada.

The present case holds that under the old law, which was in force when these cases were decided, the Commissioner had final say as to whether this section of the patent law was observed and the courts did not have jurisdiction to overrule the liberal decisions of the Commissioner. Under the law now in force, the question can be reviewed by the higher courts in Canada, and, as has been stated, they require a strict compliance with the statute.

From the above it will be seen that all owners of Canadian patents should use the greatest possible care in future in working their patents in Canada within two years, or in case extension is procured, this extension should be procured for a period of two years instead of one year, as has been hitherto the practice. Those who have already obtained extension of working time in Canada should make special note of the fact that it will be impossible for them to procure a second extension.

Brief Notes Concerning Patents.

George Craig, an aged inventor of Lyons, Mich., has invented a scheme by which he says that watchmen in banks and other similar institutions will be entirely dispensed with. His invention consists of a secret chemical compound stored in the door of the vault, which being feloniously opened allows an overpowering stench to fill the room, overcomes the intruder and renders him unconscious, in which condition he remains until he is discovered.

A collapsible lifeboat invented by Valdemar Engelhardt was recently tested by order of the Navy, War, and Treasury departments. The boat is 20 feet long and 6 feet wide. It has collapsible gunwales 2½ feet high. It is claimed for it that it can be easily handled and stowed away. The sides are composed of canvas braced by stanchions. Around the gunwales is woven a fabric of waterproof material lighter than cork. The inventor claims that his boat is unsinkable.

During the recent shortage of coal the Standard Oil Company decided to make some experiments with the use of oil as fuel. The tests were made at the works at Greenpoint and Hunter's Point, near New York, and the result was so satisfactory that it is extremely probable that the oil burners will be adopted permanently and extended to the company's other works. The device used was the invention of Henry M. Pratt, one of the millionaire directors of the company, who has worked in every capacity in many of the different yards of the company, in order to familiarize himself with the details of the work done at the different plants.

Among the recent pamphlets issued from the Census Office is one entitled "Patent Growth of the Inventive Arts, 1870-1900," which contains a great deal of interesting information about the patent system of this country. It states that the Bell telephone patent was the one which made the greatest amount of money, and the next best record was that of the four-motion feed for sewing machines. The latter is said to have netted its owners $32,000,000. The patent was first issued in 1850 for the term of fourteen years, and was twice renewed for terms of seven years. The authorship of the American patent system is discussed, and the credit is allowed to rest between James Madison and William Pinckney. Both offered orders which were allowed to go to the committee, and a clause finally reported and adopted which embodied the ideas of both gentlemen.

An automobile in which there is a total absence of belts, chains, or gearings has been designed by two New Yorkers, C. J. Dorticus and E. W. Schneider. The only noticeable feature of the vehicle is the construction of the wheels, each one of which contains an electric motor in the hub. The current is supplied from a dynamo hidden in the seat of the carriage and driven by an oil engine. One of the advantages of this system is said to be that there is almost no occasion for a vehicle becoming stranded on the road. Even if three of the motors should become disabled, which is almost out of the question, except in case of a smash-up, the one remaining motor is sufficient to bring the carriage home. The vehicle is steered by shutting off the current to the wheels on one side while it is applied to those of the other.

The Donvig life-saving globe, recently mentioned in the Scientific American, was tested on November 19 in the English Channel, while a stiff easterly gale was blowing. It is stated that the Norwegian inventor's device behaved well. The globe, without its crew, was first towed out to sea between Dover and South Foreland. A strong wind raised terrific seas, but the globe rode over the waves like cork. Capt. Donvig and three men boarded the globe after it had been towed into quieter water. The globe was then taken out to sea, where the force of the wind and seas was given full play. The globe and its occupants was cast off, but showed no inclination to roll over. After tossing about for 10 or 15 minutes, Donvig and one of the sailors emerged from a manhole, and, lashing themselves on the outside of the globe, set a small sail, which they pulled through the manhole after them. The air funnel on the globe was used as a mast. By means of this diminutive sail Capt. Donvig managed to steer the globe in a fairly straight course for several miles back to Dover Harbor.

The lifeboat invented by Mr. J. Mitchell of Manitoba, was recently launched at Dartmouth, N. S., and tested by Capt. Bloomfield Douglas, R. N. R. The boat, which is cigar-shaped, was launched from a wharf 14 feet above the level of the water. After showing the easy manner in which the boat could be rowed, the crew made a test for the purpose of proving that the boat was self-righting. With the efforts of a number of men pulling on ropes, attached to both ends, the boat was overturned. Almost instantly, it recovered its proper position. The lifeboat is capable of seating 25 persons comfortably, but can hold more. Since the boat is entirely closed, its occupants cannot perish from exposure. The boat need not be launched from a sinking ship; for it is provided with a suspending rope which runs through its entire length on the interior, through holes at both ends of the boat, and which is attached to the davits. When all the passengers have been received on board the little craft, the rope is cut from the inside, so that the boat drops and is free. A full description has been published in the Scientific American.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CORN HARVESTER AND SHOCKER.—L. L. Freeman, Kanaranzi, Minn. An economic construction of harvesting implement is provided by this invention, which is adapted to remove the ears of corn from the standing stalks and convey them to automatically-operating husking devices. The husked corn is then conveyed to an elevator which discharges the ears into a wagon or other vehicle traveling with the implement.

BAND-CUTTER AND FEEDER.—H. J. Fourtner, Hazleton, Iowa. This invention provides an improved band-cutter and feeder arranged to properly cut the bands of the sheaves, to spread the same after the band is cut, and to feed the grain to the drum of the threshing machine in quantities corresponding to the capacity of the drum, thus preventing over-feeding and consequent bad threshing of the grain.

DEVICE FOR COMPRESSING CORN-SHOCKS.—R. W., R. R. and B. E. Joslin, Manchester, Iowa. This device is especially adapted for compressing corn-shocks at any point in the height of the shock, and will hold the shock under compression until it can be tied. The construction of the device is such that it may be economically and readily applied and can be operated by one individual.

ADJUSTABLE STACK-PROTECTOR.—A. Quarrie, Oak Lake, and T. M. Morgan, J. S. Gibson, and C. S. Coatsworth, Brandon, Canada. Among other things this invention has for its object the provision of a cover adapted to be placed over a stack in such manner as to hinder rain or snow from injuring the material forming the stack and also to effect the saving of labor to the farmer in that the latter will not be required to lift or pitch the sheaves of grain as high as in ordinary stacks. The cover is so arranged that the wind cannot enter and blow it off.

STRAW-STACKER.—C. H. Brunger, Geneseo, Ill. The construction of this straw stacker is such that it is capable of being used in connection with any separator. The straw will be carried from the hopper to the stacker without injury to the straw, and the action of the racking mechanism will not be effected by any lumps of straw upon which it is required to act.

DISK GRAIN-DRILL.—J. W. Smith and J. M. Coughlin, Liberty, Ind. This invention has for its object to provide a grain-drill which will be simple, compact and efficient. Heretofore in devices of this character the seed conduit has been usually located on the convex side of a concavo-convex disk and made in one piece. In the present invention the seed conduit is made in two sections, the upper one being located on the concave side of the disk, and the lower section on the convex side, the two sections communicating through a hollow hub carrying the disk.

CULTIVATOR.—F. L. Lee, Farmington, Mich. The cultivator is especially adapted for the cultivation of beets and is operated by a check wire—the same, for example, which was employed to operate the device depositing the beet seed. In this manner the ground between the beets, and quite close to the beets, is dug up or cultivated and the cultivator blades or hoes are automatically guided at the proper time around the beets, thus preventing them from touching or in any manner injuring the plants.

HAY-STACKER.—C. W. Nickell, Jamesport, Mo. An improved hay-stacker of simple and durable construction is provided in this invention. The implement is so designed that the load can be easily raised and lowered without the necessity of backing up the draft animal used. The apparatus comprises essentially three parts, to wit, a support or mast, a fork-carrying boom, and a power mechanism for raising or lowering this boom. These parts are so designed that they can be detached one from the other, so that the entire apparatus can be readily transported.

Engineering Improvements.

ROTARY ENGINE.—S. E. Carothers, Conroe, Texas. In the present invention the rotary piston is operated concentrically within the cylinder and is provided with blades which bear against the inner surface of the cylinder. Sliding abutments serve to divide the space between the cylinder and the piston body into chambers which are at the same time properly connected with the steam inlet and the exhaust. The abutments are withdrawn to clear the piston blades by a cam movement.

LUBRICANT ATOMIZER.—C. C. Baldwin, Momence, Ill. Means are provided in this invention for lubricating the valves and interiors of steam engine cylinders, pump cylinders, or like portions of other motors using live steam, air, gas, etc., as a motive agent. The device employed is adapted to reliably distribute oil in an atomized condition to the interior parts of the steam motor requiring periodic or continuous lubrication.

Hardware.

SPIRIT-LEVEL.—L. Desmarais, New York, N. Y. In this spirit level the spirit tube is adjustable and easily removed. The spirit level comprises a pair of revoluble sleeves disposed concentrically to each other, one of these sleeves being provided with a spirit tube, and means controllable at will for rotating one of these sleeves independently of the other.

CURTAIN-FIXTURE.—C. B. Lakin, Washington, D. C. The object of the present invention is to provide a novel construction by which a curtain may be raised and lowered, as usual, may be secured with its roller at the top of the window, or at any lower point, and can be readily operated from one position to the other in such manner as to admit light from the upper or lower portion of the window, or from both upper and lower portions.

WIRE-STRETCHER.—B. Myers, Groveport, Ohio. A tool which can be conveniently applied and operated for stretching wire is provided by this invention. The jaws of this wire stretcher are so arranged as to grasp the wire simultaneously the entire length with equal pressure throughout, thus preventing the wire from being kinked or nicked.

Heating, Ventilating and Plumbing.

OIL-BURNER.—W. S. Jenkins, Cleburne, Texas. Mr. Jenkins' invention relates to improvements in oil burners particularly for use with steam boilers. The construction of the burner is such that a very high degree of heat may be produced with a comparatively small amount of hydrocarbon oil, and in which very little steam is required for vaporizing the oil.

OIL-BURNER.—C. W. Sievert, Los Angeles, Cal. An improved device for burning oils has been invented by Mr. Sievert. The device is adapted more particularly for burning the heavy oils, such as crude petroleum, and it comprises certain novel features of construction by which the oil is effectively gasified and mixed with air so as to produce thorough combustion.

VENTILATOR.—G. G. Britton, Anniston, Ala. The invention relates to improvements in ventilating cowls for use on buildings and other places. The device is so arranged that the entrance of wind, from whatever direction it may blow, is effectually excluded, so that the outside air will not have any effect on the draft through the tubular ventilator stem.

Mechanical Devices.

YIELDING ROLL.—B. F. Conkle, Junction City, Ohio. Mr. Conkle's invention is an improvement in yielding rolls for use on planing machines and the like, wherein it is desired to form the roll in sections, each section being capable of an independent yielding movement so the different sections may adjust themselves to the varying thickness of the material fed to the machine.

STEAM-SHOVEL.—F. Franz, Wallace, Idaho. This invention relates to machines for shoveling and conveying earth, rock and like substances. The shovel travels along a boom which may be swung to any desired position and conveys the earth to an endless conveyer. The endless conveyer carries material up an incline and dumps it from the high end of the conveyer into any suitable receptacle.

BOOKBINDING-MACHINE.—W. E. Blauvelt, Brooklyn, N. Y. This machine is designed to affix the crash, the head bandings and the paper lining to books preparatory to the final binding. The machine in addition to the mechanism for performing the above mentioned functions in the sequence named, has a novel and simple device for folding the head bandings, inserting the cord and cutting the material in proper lengths from a roll. After affixing the head bandings the book is transferred by the machine to the device for applying the paper lining, the paper being first drawn through an adhesive and cut to the required length. While the machine is in constant operation, each applying device is performing its particular function on a book and therefore the work is rapidly done. Each applying device comprises two platens which operate on the material with a lateral rubbing and smoothing motion, thus insuring a smooth and well finished product.

POWER-HAMMER.—H. Feldus, Hallam, Neb. This power-hammer, which is of a very simple construction and is very effective in operation, is more especially designed for light work, such as hammering plowshares, plow points and other articles. The arrangement is such as to enable the operator to control the hammer for the latter to strike quick, sharp blows, or slow, light blows, according to the nature of work under treatment.

DITCHING-MACHINE.—Clementine Chapman, Dolores, Colo. Among the improvements provided by this invention is the provision of a simple, compact, and cheap machine, which is especially adapted to the work of cleaning out irrigating and draining ditches, so as to restore them to a good condition for service.

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Means are provided for cutting roots and the sod at the sides of the ditch, and provision is made for the elevation and discharge of the soil at the sides of the ditch and to open the way for the penetration of the share at the bottom of the ditch.

Medical Devices.

APPLICATOR.—W. C. HOLT, Oakley, Kan. This applicator is adapted for the application of medicaments to the vagina, cervix, and other uterine organs, the rectum, and also to other internal parts of the human body. The invention provides a device which can be readily cleaned and by means of which a tampon may be quickly and neatly applied by the person receiving treatment. The device also serves to render positive the application of medicines without loss before a full entrance has been effected.

Railway Improvements.

CAR-TRUCK.—R. E. POWERS, Johnstown, Pa. Mr. Powers' invention is an improvement in truck frames for railroad cars. The side frames for the trucks are cut from an I-beam and reinforced by binder strips of angle metal. The frame can thus be strongly and at the same time very cheaply made.

Vehicles and Their Accessories.

SPEED-VEHICLE.—F. S. STODDARD and F. E. WHITNEY, Syracuse, N. Y. The present invention relates to a vehicle of the type suitable for driving at high speeds. The shafts are fastened to a point lower than the bottom of the vehicle and yet higher than the spindles of the front axles, this point having been found to be most advantageous. If the draw-irons be placed at a point higher than this, the animal will, to some extent, be pulling the vehicle toward the earth, and if placed lower than this, he will be lifting the vehicle somewhat. The fifth wheel is practically as wide as the vehicle body in this construction, thus greatly strengthening the vehicle and at the same time preventing undue rocking movement or an excess of lost motion when the vehicle is strained into different positions.

DRIVING MECHANISM FOR VEHICLES.—L. G. NILSON, New York, N. Y. It is a common practice to place the driving gearing for electric automobiles, such as chains or spur gears, directly on the spokes or very close to the drive wheels. The disadvantage of this is that such gearings catch considerable sand or grit which may fall from the wheels, causing the gearing to wear out quickly, and it is practically impossible to encase the gearing. The present invention overcomes the above-mentioned difficulties by so arranging the parts that the driving mechanism is placed between the body-supporting springs and remote from the wheels, where it can be completely encased.

Miscellaneous Inventions.

FOOT-SHIELD.—W. E. BOSWORTH, Frankfort, Ky. When pulling on a shoe the under part of the stocking engages the insole of the shoe and produces a pulling effect on the ends of the toes which tends to draw and turn under the toes into a cramped and unnatural position. This causes much discomfort and results in the probable formation of corns. To obviate such cramping, Mr. Bosworth has invented an attachment which may be placed over the end of the foot to prevent all such frictional contact.

DIE FOR COVERING TUBES.—P. H. FRIEL, Kenosha, Wis. The present invention is an improvement upon a former invention patented by Mr. Friel. It consists of a die of such construction as forms the double lock-joint with flush parallel edges, which makes a stronger and more nearly invisible joint than the single lock-joint heretofore used on the die as already patented.

SAD-IRON HOLDER.—K. BARNICKOL, Rome, N. Y. The object of this invention is to provide a holder for heated sad irons which is connectable with an ordinary ironing board, and when in place is adapted to receive a hot sad iron and hold it reliably against lateral displacement.

FASTENER FOR GARMENTS, ETC.—J. L. DINKELSPIEL, New York, N. Y. This invention relates to a device for fastening together the parts of a garment or other structure of cloth, leather or other material. The present invention provides certain improvements in the construction forming the subject-matter of patent previously granted to Carrie P. Parker.

CISTERN-FILTER.—J. W. CRAINE, Winfield, Kans. Mr. Crane's invention relates to a cistern filter which will purify water as rapidly as the same is removed from the cistern. Provision is made for removing undue pressure from the water upon the interior of the filter and also for permitting the ready entrance and egress of air to and from the filter.

HOSE-COUPLING.—H. T. CRONK, New York, N. Y. Mr. Cronk provides in the present invention an improved hose coupling which relates to a previous invention patented by Mr. Cronk. The ends of the hose are turned back forming a flange, and coupling sections engage these flanges and are held together by clamping nuts.

GARMENT-RACK.—C. DOUBLAT, New York, N. Y. This garment rack is especially adapted for use in hotels and other places where a number of garments are to be taken care of. The construction of the rack is such that the wraps and umbrellas and canes of the various guests can be quickly and accurately arranged, classified and returned in good condition to their owners without the liability of mistakes.

COOLING APPARATUS.—J. E. HAARMANN, Omaha, Neb. An apparatus for cooling fluids particularly liquid or semi-liquid substances is provided in this invention. It is especially adapted for use in distilleries, starch and sugar factories, breweries, glucose works, and other manufactories where material is cooked or boiled.

FOLDING CHAIR.—S. R. ROGERS, Mount Airy, Ga. This invention relates to improvements in folding chairs, the object being to provide a chair that may be readily adjusted to any desired position, or folded in compact form so that it may be easily carried or transported from place to place.

BROILER.—R. P. SMITH, New York, N. Y. This improved broiler is especially intended for buffet and other use where the space is limited. Such, for instance, as in the buffet kitchens of parlor cars, apartment houses, or private residences, yachts and the like.

CONVERTIBLE ARTICLE OF FURNITURE.—W. M. BOAZMAN, Greenville, S. C. This improved article of convertible furniture may serve as a stationary bed or lounge, also as a rocking lounge, cradle, or chair, a rolling chair, or reclining chair. The changes or adjustment of parts required to adapt it for any one of these articles is effected by a very simple manipulation.

FOLDING LADDER.—H. LABRANCHE and F. THIROT, 114 Avenue de Suffren, Paris, France. The present invention relates to an improved folding ladder of the kind which comprises rigid sides connected together by means of steps, the ends of which are pivoted or jointed to these sides, so that the latter can be brought together, the one against the other, when the ladder is not in use.

FASTENER FOR SHOW-CASES.—P. S. SCOTT, Brooklyn, N. Y. The fastener is more particularly intended for use on show-cases on the outside of stores, where they are exposed to the weather and to the view of the passing public. In show-cases of this class it is desirable to provide a lock-hasp which cannot be pried or broken open by thieves, and which at the same time is capable of preventing rain or dust from entering the crevice at the point of application of the hasp. Such a device is provided in the present invention.

TILING FOR FLOORS, WALLS, CEILINGS, FIREPLACES, ETC.—F. ALCAN, New York. The object of the invention is to provide an improved tiling arranged to permit of setting the tile blocks in such a manner as to form color patterns, greatly resembling those of oriental rugs, and hence greatly enhancing the artistic merit of the structure on which the improvement is used.

CIGAR HOLDER AND ASH RECEIVER.—J. C. D. ROSS, Chicago, Ill. Mr. Ross's invention relates to improvements in combined cigar holders and ash receivers. It provides a simple and cheap article adapted to hold a cigar in position for the ashes to drop into a receiver, thus preventing the ashes from dropping on and soiling the clothing of the smoker. The holder may be adjusted as the cigar burns away to bring the receiver into proper position for catching the ashes.

BOX-COVER SUPPORT.—S. B. EVANS, Enid, Okla. Ty. A device for holding the cover or lid of cigar boxes in open position to display the contents of the box to purchasers is provided by Mr. Evans' invention. The device may be cheaply manufactured and easily applied to securely hold the box cover in the desired rearwardly inclined open position. It may also be readily removed from an empty box and reused on a new one.

HEAD-GATE.—H. W. ELDER, Dawkins, Colo. This improved head-gate is adapted for use in irrigating ditches and the like, and is arranged to form a portable dam in the ditch to control the water flowing through the ditch upon the land to be irrigated without danger of the water leaking past the gate at the sides. The arrangement also is such as to prevent the bottom of the ditch from unduly washing out at the downstream side of the gate.

PHOTOGRAPHIC CAMERA.—W. F. FOLMER, New York, N. Y. The invention relates particularly to reflex cameras, and it provides for automatically setting the shutter while depressing the mirror and making the exposure automatically when the mirror is released. Means are provided for automatically opening the diaphragm to a full aperture when setting the mirror and permitting the operator to diaphragm the lens to whatever stop may be desirable.

Designs.

POKER-CHIP.—S. A. COHEN, New York, N. Y. The design consists of a representation of a shield bearing on its face the representation of a raging lion in horizontal position and surmounted by a crown having a cross and flanked, on both sides by leafy branches, the whole being surrounded by a circle.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 3659.—For a machine for cutting light leather into narrow strips about ¼ inch wide.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3660.—For makers of tool steel balls.

Coin-operated machines. Willard, 284 Clarkson St., Brooklyn.

Inquiry No. 3661.—For 1892, 1893, 1894 or 1895 make of drop frame ladies' bicycles, weight 35 or 40 pounds.

Dies, stampings, specialties. L. B. Baker Mfg. Co., Racine, Wis.

Inquiry No. 3662.—For machinery for making starch from rice.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3663.—For manufacturers of mop-wringers.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 3664.—For makers of model castings for steam and electrical machinery.

Want metal novelties of any kind, any quantity? Write Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 3665.—For dealers in advertising novelties.

Patented articles, principally of cast iron, made and introduced. Atlantic Foundry, Philipsburg, N. J.

Inquiry No. 3666.—For makers of ice and creamery plants.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 3667.—For manufacturers of fringing machinery.

Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 149 Varick, cor. Spring Streets., N. Y.

Inquiry No. 3668.—For manufacturers of caps.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3669.—For firms who install factories for the production of artificial manures from bodies of dead animals.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

Inquiry No. 3670.—For makers of electric clock alarm bells for colleges and schools.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3671.—For dealers in small novelties.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Patent No. 694,279, horse ties, for sale outright or on royalty. J. T. Horris,
299 Lexington Ave., New York.

Inquiry No. 3672.—For parties to make small, magnetic electrodes.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3673.—For the address of parties who make cardboard 3-16 inch thick and one side faced.

Africa advertiser open to represent any business or will purchase for cash notions or novelties. Catalogues, prices and samples to Mr. A. Nickson, 8 Airths Buildings, Smith Street, Durban, Natal, South Africa.

Inquiry No. 3674.—For makers of toy printing presses, also stencil manufacturing sewing machine companies.

Gasoline Automobile Batteries. William Roche's "Autogas" used properly will carry vehicle twice as far as any other battery of same weight. William Roche, inventor and manufacturer, 42 Vesey Street, New York, N. Y., U. S. A.

Inquiry No. 3675.—For parties to make telephone brackets to order.

A public exhibition of American and foreign inventions will be held for two weeks in February at Buffalo. Object, practically presenting them to manufacturers and capitalists. Modern Invention Exhibit Company, 124 Erie Co. Bk., Buffalo, N. Y.

Inquiry No. 3676.—For machinery for making cigar boxes.

FOR SALE.—Patent No. 717,281 "Novelty" new article of manufacture, "Cigar Holder and Ash Receiver." This will surely supply a long-felt want for smokers, especially at offices, clubs, homes, etc. Julius C. D. Ross, 685 Burling Street, Chicago, Ill.

Inquiry No. 3677.—For an electric motor from 6 to 8 h. p. of the alternating type.

Inventors wishing to sell their patents or to have them manufactured on royalty will find it to their interest to correspond with me.
J. C. Christen,
Main and Dock Sts., St. Louis, Mo.

Inquiry No. 3678.—For machinery for extracting the fiber from Lechuguilla, Maguey or Heniquen.

Inventors and parties desiring to have patented articles manufactured please take notice:—An old established New England concern, with large experience in manufacturing and marketing specialties of different kinds, desires to obtain control of patented inventions of merit, and would either purchase same outright or manufacture on royalty. All communications will be considered strictly confidential, and we reserve the right to reject any or all inventions submitted.
Address P. O. Box No. 316,
Bridgeport, Conn.

Inquiry No. 3679.—For makers of steam turbines.

Inquiry No. 3680.—For makers of small turbine water wheels.

Inquiry No. 3681.—For parties to make a small steam engine to order.

Inquiry No. 3682.—For a motor for running a sewing machine.

Inquiry No. 3683.—For makers of gasoline engines.

Inquiry No. 3684.—For the makers of the Bunsen burners for gas mantle lamps.

Inquiry No. 3685.—For makers of the dry gold washer for placer mines.

Inquiry No. 3686.—For a trolley box or device for delivering mail from rural routes to houses on the routes.

Inquiry No. 3687.—For a 10 h. p. gasoline engine to operate a 150 light dynamo for electric light work; one in which the regulation is as good as a steam engine.

Inquiry No. 3688.—For makers of running gear, wheels, axles, tires, motor, etc., for automobiles.

Inquiry No. 3689.—For new or second-hand brick-making machinery.

Inquiry No. 3690.—For dealers in strip tool or spring steel of special sizes.

Inquiry No. 3691.—For manufacturers of gas mantels.

Inquiry No. 3692.—For makers of ornamental faucets for fancy coffee pots, etc.

Inquiry No. 3693.—For dealers in electro-plating supplies.

Inquiry No. 3694.—For makers of corn broom machines.

Inquiry No. 3695.—For makers of electric launches.

Inquiry No. 3696.—For makers of strong, durable gasoline automobiles for rough country roads.

Inquiry No. 3697.—For makers of machinery for making common pins, hat pins, etc.

Inquiry No. 3698.—For makers of glass jars and labels.

Inquiry No. 3699.—For makers of whiting.

Inquiry No. 3700.—For makers of concrete mixers.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled

(8786) F. B. asks: How many pounds pressure would I get on a 12-inch pipe, running to a turbine, with a tank of water holding one and one-half million gallons of water, with a ten-foot fall? How many horse power would it give me? How many horse power would I gain with every ten-foot fall through the same pipe? How many horse power will it require to lift a six-inch stream of water 100 feet with the best pump, and will it take twice as much power to lift a 12-inch stream the same height? A. You would have 4 1-3 pounds per square inch pressure at the turbine. It is possible to obtain 5 horse power from the 12-inch pipe, and the same for each additional 10-foot fall. It will require about 12 horse power to fill your 6-inch pipe at full flow, and four times as much power for a 12-inch stream with four times as much water.

(8787) T. O. C. states: I have made an electro-magnet as follows: The cores are 1 1-16 inches in diameter, 3¼ inches long, wound with No. 22 magnet wire (double cotton-covered) 12 turns on each spool, the spools three inches clear in length; there is nearly 1 pound of wire on each spool. I want to use it on 110-volt current, but if the current is on for a few seconds, the wire on spools gets pretty warm. Can I avoid the heating by changing the dimensions? I would rather do that than put a lamp in the circuit, if it is possible. I want the magnet to overcome 8 or 10 pounds spring pressure. A. The difficulty with your magnet is excessive current. Two pounds of No. 22 wire will not have more than 16.6 ohms resistance. This at 110 volts will allow about 6 amperes to flow, and the wire cannot carry that current. You must either wind on much more wire, probably three times as much, or use some external resistance, the simplest form of which is a bank of lamps, so arranged as to allow the proper amount of current to flow.

(8788) A. W. F. writes: Is not your advice to C. R., Query No. 8725, a little dangerous in spite of your caution? For instance, if a quantity of guncotton less than a bursting charge were exploded in a strong tube, would not the initial pressure of the liberated gases remain constant until the gases were allowed to escape, less the reduction of pressure caused by cooling to normal temperature? Therefore, would not the danger be great to suddenly liberate this great pressure by unscrewing the confining plug, as per C. R.'s question No. 2? A. Your suggestion is very proper in regard to suddenly liberating the high-pressure gases of combustion of guncotton. In unscrewing a plug that would be used in such an experiment, the high pressure would be wasted by leakage over the thread before the plug could be unscrewed.

(8789) R. J. asks: Can you kindly advise us as to the best means of oxidizing yellow and red brass (in castings or in rolled sheets) copper and bronze? We have several showcases, the metal trimmings of which are backed with wood, rendering it impossible to heat same sufficient to oxidize in the usual manner. A. If the blackening effect is the one desired (and this is what is known as "oxidizing" in the trade) it can be obtained by using a very dilute solution of potassium sulphide, to which sometimes a little ammo-

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nium sulphate is added. As the article itself cannot be heated, it will be well to heat the solution of potassium sulphide.

(8790) H. J. K. says: I desire to deposit nickel directly on a wax mold, and to do this it is of course necessary to first make the wax mold conductive. The molds are blackleaded first. What I would like to know is, what kind of a conductive coating is best to apply. Some use a solution of nitrate of silver and phosphorus. Can you tell me how to proceed with this? It is for use in making nickel-faced electrotypes. A. The blacklead (graphite) is applied to act as the conducting surface upon which the metal is deposited. You are evidently misinformed as to the nitrate of silver and phosphorus; these are not used. A good account, with formulæ, for the process of blackleading and nickel plating, will be found in the "Scientific American Cyclopedia" articles, "Electrotyping" and "Electro-metallurgy."

(8791) E. O. H. asks: Will you kindly inform me what composition pulp or fiber water pails, tubs and trays are made of? Also kindly explain how they are formed or pressed. A. Old paper stock is boiled to a pulp with water. It is then pressed to remove the excess of water and mixed with glue, gum, dextrine, starch paste or rosin size and pressed into oiled molds under heavy pressure. Dry. Then soak with linseed oil and dry with heat. It is usual to add some mineral weighting material to the pulp, such as clay, chalk, barytes, etc.

(8792) F. R. J. asks: How should paper be treated (manila or wood pulp or straw paper) to prevent mold when placed on damp or moist surface? A. Any antiseptic chemical can be used; as these are all poisonous, paper so treated must not come in contact with edibles. Bichloride of mercury, sodium fluoride, carbolic acid, salicylic acid, or benzoic acid are a few of such chemicals. The essential oils are also very good, and would not be poisonous to any extent; dissolve in alcohol and flow it over the paper to be treated. Oil of sassafras is one of the cheapest that can be so used. Oiling or paraffining the paper will also serve.

(8793) P. M. C. says: We desire some cheap adhesive substance that can be used in manufacture of briquettes to contain charcoal and sawdust. A. Coal tar and molasses are the substances used for briquetting, and are both quite cheap.

(8794) H. B. says: In looking over the Scientific American of October 25, 1902, I notice reference made to the water pail forge. In your reply to 8722, K. T., will you kindly let me know the construction and use of the water pail forge, as we desire to use in shop if it is practicable. A. The "water pail forge" may be easily constructed by placing a sheet of lead in the bottom of a common water pail. It would better be large enough to cover the bottom and have a strip up one side of the pail to the top, to which the positive wire is attached. Fill the pail about half full of a liquid composed of washing soda 10 parts, borax 1 part, and water to a specific gravity of 1.15. Make a couple of notches in the edge of the pail and lay an iron bar across the top of the pail to which the negative wire is attached. Take the article to be heated in a pair of tongs, place the tongs against the iron rod and thrust the article to the desired depth in to the water. A pressure of 220 volts is necessary for rapid heating. A rod of iron one quarter inch through will be red hot in a second or two. A large soldering iron is hot in a few seconds. It works too fiercely to be easily controlled, and for this reason it has not come into use in shops. The metal is soon melted and falls in drops.

(8795) E. E. S. desires a method of identifying the element rhodium, also its chemical reactions, which would enable one to test ores for the presence of the above-named substance. A. The separation and detection of rhodium is difficult and requires expert chemical work; it would be impossible to give any simple method of detection, as it is always associated with other metals of the platinum group. There is no book published devoted to the analysis and separation of the rare earths. The information must be obtained by consulting the various standard works on chemical analysis and by looking through the journal literature. Fresenius' "Qualitative Analysis" gives considerable information as to rhodium, as well as on the other rare metals.

(8796) J. W. W. wishes to know what is best for a mold to burn a substance at a red heat that will not crack or give? Have tried wrought iron. Cast sometimes gives or bends. How would fire clay or the same composition as Berlin crucible do? Can you give me a formula for it? A. Fire clay, mixed with some molder's sand, or kaolin, can be used for making such molds. If mixed with stale beer or ale, it gives a firmer mold than if mixed with water. Phosphate of lime, also mixed with stale beer, gives a very clean, white mold, but is not strong. Thoroughly dry and bake before using.

(8797) B. D. wishes a receipt for a glue which will satisfactorily glue celluloid to wood, such as is used in making draughtsman's tie squares of celluloid and wood. A. A very simple formula recommended for this purpose is to heat glue to boiling, and stir in gradually wood ashes until the consistency is similar to a thick varnish. Use hot.

NEW BOOKS, ETC.

Annals of the Astronomical Observatory of Harvard College. Vol. XLIV. Part II. Reduction of Observations made with the Meridian Photometer During the Years 1892-98. By Edward C. Pickering, Director of the Observatory. Cambridge: Published by the Observatory. 1902. Pp. 115-216.

How to Attract the Birds. And Other Talks About Bird Neighbors. By Neltje Blanchan. New York: Doubleday, Page & Co. 1902. 8vo. Pp. 224. Price $1.35.

The author has presented us with a book which tells much of birds that is probably not contained in any of the animal books now so widely read. The title of the work is somewhat misleading, for a goodly portion of the volume is devoted to a popular exposition of the principles of ornithology. The manner in which this book is written is extremely personal. For that reason it is far more readable than a cold description of bird habits. The publishers have seen to it that the work appears in a handsome dress.

The Journal of the Department of Agriculture of Victoria. April, May, June, July. Published for and on behalf of the Government by Direction of the Hon. John Morrissey, M. L. A. Edited by H. W. Potts, F. C. S., F. L. S. Melbourne. 1902. Pp. 457-535.

The Painter's Laboratory Guide. A Handbook of Paints, Colors, and Varnishes for Students. By George H. Hurst, F. C. S. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1902. 12mo. Pp. ix, 248.

In writing this laboratory manual, the requirements of students who can attend practical courses in the subject of painting at some technical school or college, as well as those students who, although unable to attend such courses, desire the benefits obtained from a course of experimental work, have been kept in view. In his sections on pigment making, the author enters into some description of the chemical principles on which the preparation of pigments is based, as well as of the chemical properties of pigments. Short notes on pigment manufacture on a large scale are likewise introduced. In the section on lakes special attention to the preparation of lakes and coal-tar dyes is given. Experiments are described which can be carried out by students whose time is limited.

A Textbook of Physics. By J. H. Poynting, Sc.D., F.R.S., and J. J. Thomson, M.A., F.R.S., Hon. Sc.D. Dublin. Properties of Matter. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1902. 8vo. Pp. vi, 228.

With this volume on the Properties of Matter, Profs. Poynting and Thomson open a series comprising a textbook on Physics. The second volume, that on Sound, has already been issued, and the remaining volumes, dealing with Heat, Magnetism, Electricity and Light, will be published as soon as possible. Like its predecessor on Sound, the present volume is intended chiefly for the use of students who lay most stress on the study of the experimental part of physics, and who have not yet reached the stage at which the reading of advanced treatises on special subjects is desirable. To bring the subject within the compass thus described, an account is given only of phenomena which are of special importance, or which appear to throw light on other branches of physics. The mathematical methods adopted are very elementary. In the present volume the authors deal with weight, mass, gravitation, and those properties of matter which relate chiefly to change of form, such as elasticity, fluid viscosity, surface tension, diffusion and solution.

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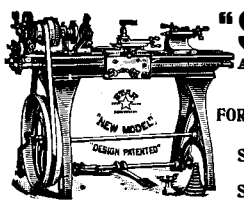
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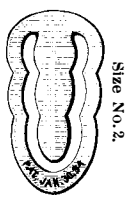

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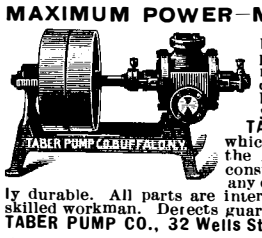

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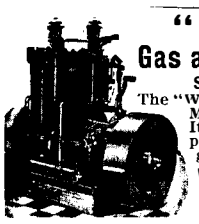
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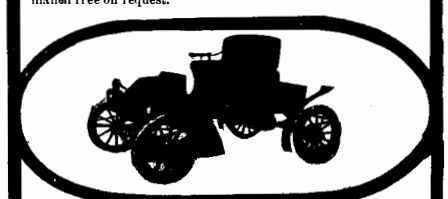

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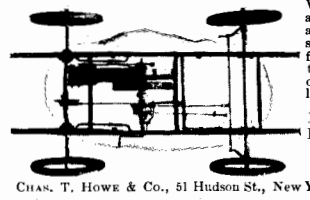

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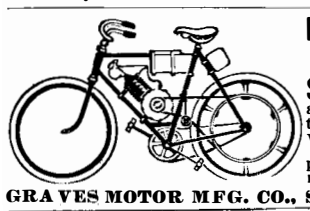

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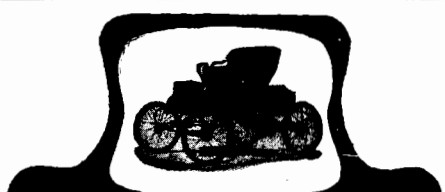

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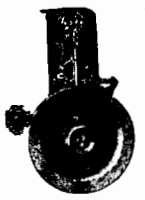

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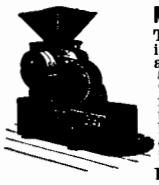

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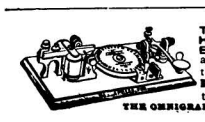

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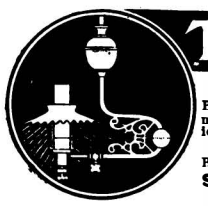

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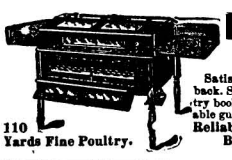

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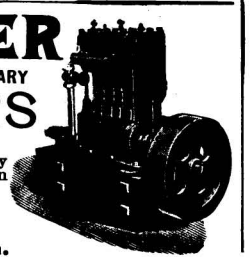

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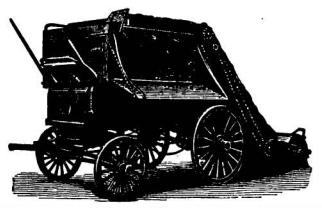

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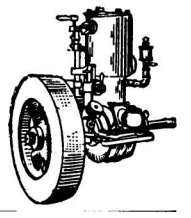

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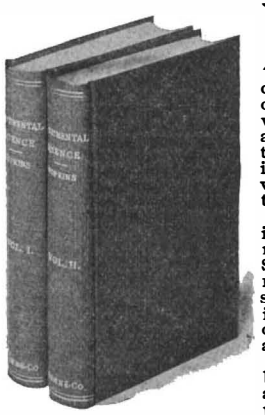

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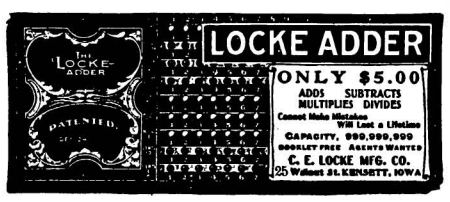

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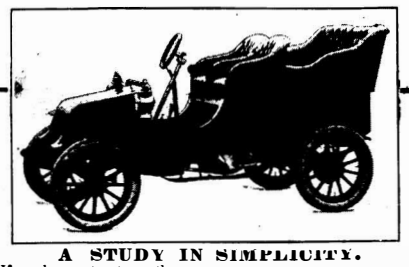

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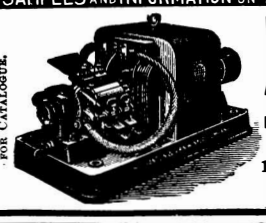

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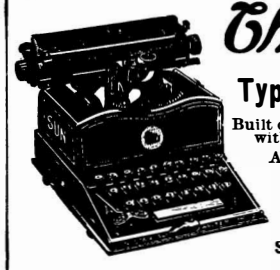

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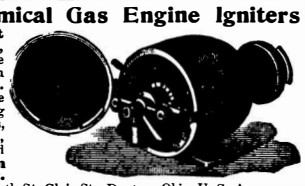

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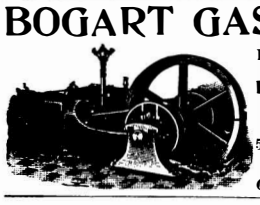

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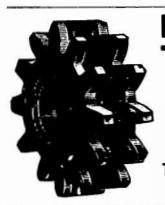

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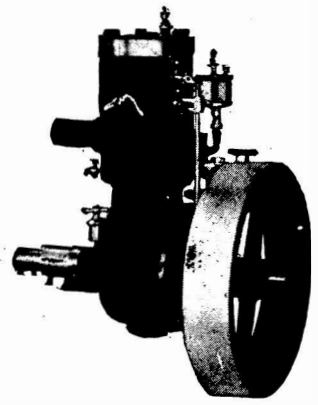

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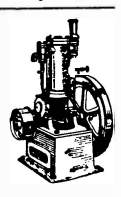

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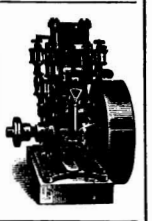

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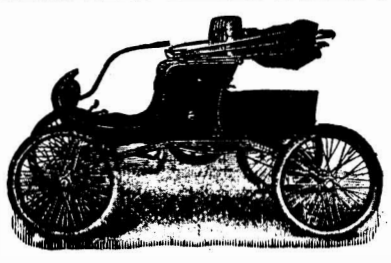

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